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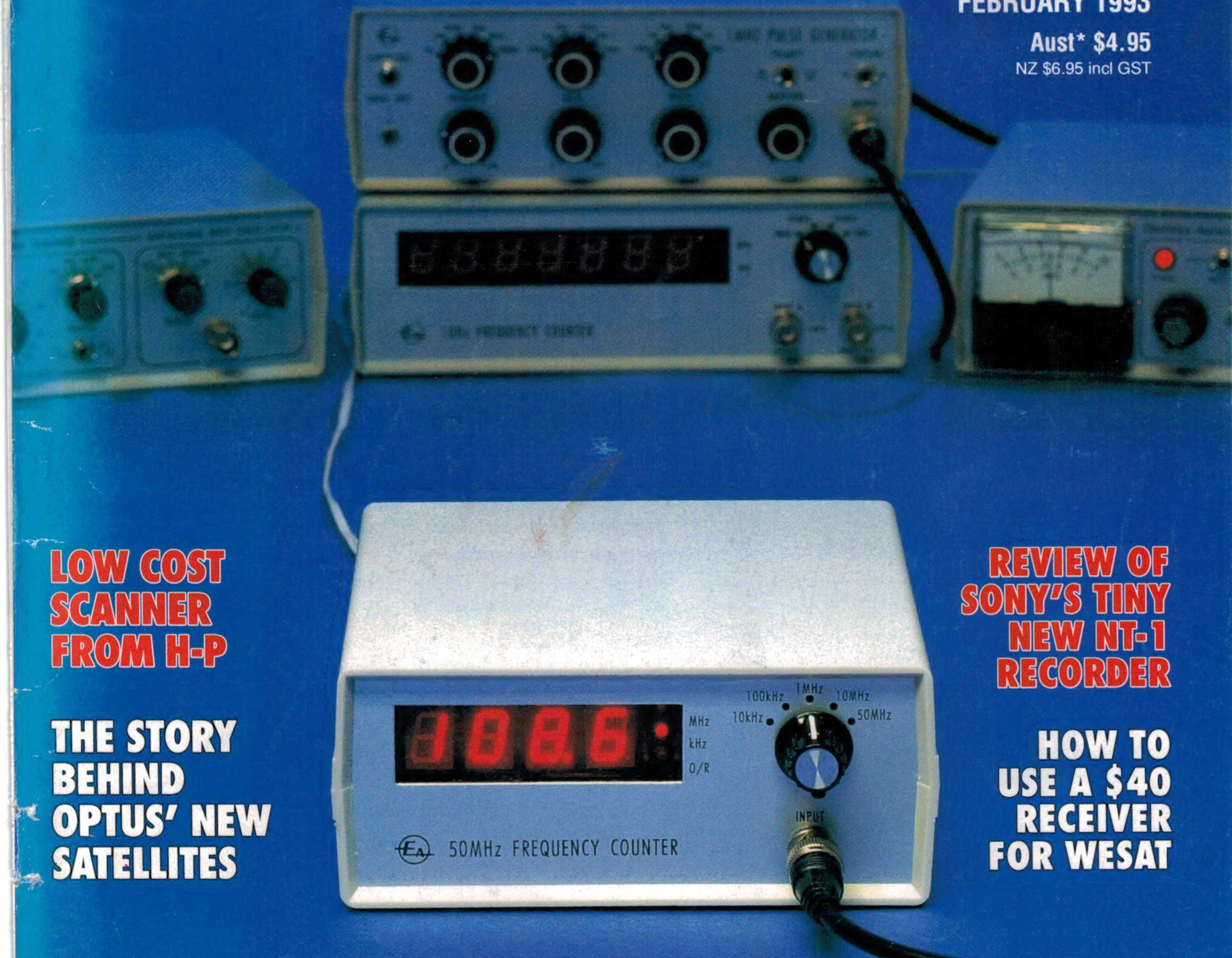

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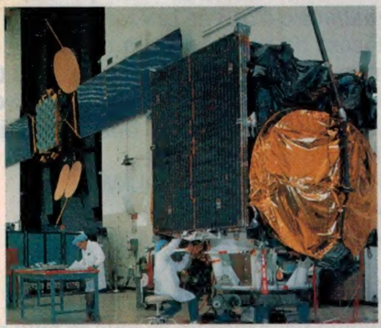
Volume 55, No.2

Electronics Australia WITH eti

February 1993

AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE — ESTABLISHED IN 1922

The B1 satellite story



The new Optus B-series satellites are now in orbit, signalling the dawn of a new era for Australia's broadcasting and communications. Kate Doolan tells the story of how the B1 satellite was built and launched, in her story starting on page 10.

Not for the majority...

Sydney-based TV Oceania is already broadcasting Pay-TV every night — but not for most of us. It's in Japanese, for tourists and visiting business people. Barrie Smith explains, in his story starting on page 6.

On the cover

Our new 50MHz counter project is the latest addition to our 'cheap but useful' instrument family. Essentially an update of our very popular 1988 design, it will make most commonly needed measurements yet should only cost around $100. See page 68. (Photo by Greg McBean)

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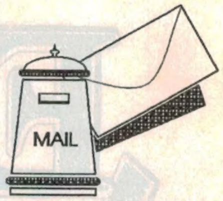
LETTERS TO THE EDITOR



WESAT reception

I am writing to you regarding some comments you made in your review in *EA* September 1992 of the SATFAX software.

Your comment that "The WESAT signals use a deviation of around 30kHz" is incorrect. The satellites transmit a deviation of +/-17kHz of the carrier (this varies about one or two kHz with individual satellites). GMS-4 (1691MHz) on the other hand transmits with a deviation of +/-126kHz.

To reproduce the full greyscale of the image a receiver bandwidth of 50kHz is ideal, as it also takes into account the +/-3/4kHz of doppler shift that is experienced during the satellite pass.

Your comment that wide-band FM receivers can be used successfully is not true in most cases. Certainly under ideal signal conditions some *useful* pictures will be obtained, but in the main the results will be very disappointing.

The 150kHz bandwidth of these receivers results in noisy images at best. My tests on an AOR receiver indicated around 30uV of signal was necessary to obtain a useful signal, certainly not a fully quieting signal. A YUPITERU scanner was somewhat better at 0.7uV for a similar signal quality.

A correctly designed receiver with a 50kHz bandwidth will achieve this order of signal quality around 0.3uV, an improvement of 20dB over the AOR receiver.

If you are still in doubt, have a close look at Tom Moffat's two pictures, although they appear on the surface to be OK, they do in fact contain quite a lot of noise, a pity, as the METEOR picture would have been a ripper on a 50kHz receiver!

Tom must also be very lucky to be in a low noise area; compare this with your own experiences. Adding a pre-amplifier will only degrade the already poor overload cross and inter-modulation performance of these receivers. Post detection filtering will only achieve a minimal improvement in signal quality.

From the above, your comments in the SATFAX article that my GMS receiver which has a typical bandwidth of 280kHz at -3dB is suitable for APT reception is definitely not true. It was specifically designed only as a tuneable IF for GMS reception on 1691MHz using a suitable downconverter.

As a guide my own APT receiver has the following measured specifications: sensitivity, 0.2uV for 12dB Sinad; bandwidth, 50kHz at -3dB points; and signal/noise 42dB at 1uV.

Please do not take these comments as a 'rubbishing' of Tom's efforts, quite the reverse, in fact, as a keen 'home brewer' myself any articles on this interesting hobby are most welcome.

Peter Williamson, VK4AWP
Albany Creek, Qld.

Comment: I stand corrected, Peter!

Dick needs book

Would your readers be able to help me find a book?

In the mid-1950's, as a young radio enthusiast eagerly reading every issue of *Radio & Hobbies*, I built a radio which was described in an English book. If I remember correctly, the circuit consisted of two battery valves (could it have been a 1S4 and 3S4?) regenerative radio, complete with Reinartz coil.

The distinguishing part of the radio was that it was built on a wooden chassis. The book was hardcover, published in the United Kingdom in early 1950.

I can remember well that the radio ran on an expensive 67.5 volt battery which took me six weeks on my paper run to pay for. I would love to purchase a copy of this book for old time sake.

If any of your readers could help, I would be delighted. By the way, *EA* is an excellent publication — I still read every issue!

Dick Smith,
Australian Geographic,
PO Box 321,
Terrey Hills, NSW 2084

Satellite power

I read with interest the article in December, about the tethered satellite experiment. This experiment was in part to find out if electrical power could be developed by a long conductor cutting the earth's magnetic field. The result would be a DC voltage between opposite ends of the conductor.

The piece of information the article did not convey was where is the return

path for the electrical power so generated? The diagram of the power generating cable showed only one single conductor.

To further add to the mystery, even if there was a return conductor, would it not generate the same voltage, and in so doing cancel out the voltage in the other conductor? One of the cables would have to be magnetically shielded.

Obviously, this power generating system works, but on the information given I cannot understand how.

All the best at *Electronics Australia*.

Will McGhie,

Lesmurdie, WA.

***Comment:** As we understand it, Will, the return path is via the ionised plasma which surrounds both the satellite and the tether line. The Shuttle had to have an 'ion gun' unit, to effectively make contact with the plasma.*

To be honest, though, we're not too sure how this whole system could be used to generate power — like all such systems, all it does is convert mechanical energy (the satellite's orbital kinetic energy) into electrical energy. No energy comes from the magnetic field or plasma...

AAPRA and BayCom

I enclose a copy of the fax of the letter to you from Johannes Kneip of the BayCom team in Germany, which I trust you have received direct by mail.

This is to clarify that AAPRA referred to in item 1, is the Australian Amateur Packet Radio Association.

AAPRA can supply a registered copy of the BayCom program Version 1.5a on 5-1/4" or 3-1/2" disk, complete with Australian produced 48-page manual, for A$25.00, postage and packing included.

AAPRA can also supply the BayCom designed and built modem inside a DB9 plug, complete with program disk and manual as above, for A$180.00, postage and packing included.

Any profits from the sale of equipment are used to help clubs establish network nodes (ROSE). Over $20,000 has been contributed to date.

John Barrett, VK2AUQ, for AAPRA

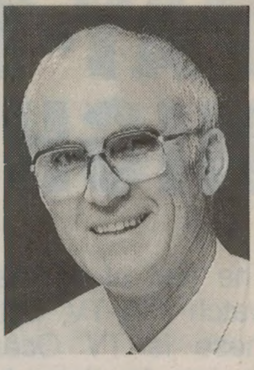
59 Westbrook Avenue,

Wahroonga, NSW. 2076

DROP US A LINE!

Feel free to send us a letter to the Editor. If it's clearly expressed and on a topic of interest, chances are we'll publish it — but we reserve the right to edit those that are over long or potentially libellous.

EDITORIAL VIEWPOINT



Dawn of a new era in communications and broadcasting

As I write this, Australia has clearly just entered a new era in satellite communications and broadcasting. A couple of days ago on December 16, the first of Optus Communications' new B-series satellites took over from the original Aussat A1, which after seven years of service had reached the end of its operational life. The changeover took place very smoothly, with a disruption to all services of less than 40 seconds — surely remarkable, considering the complex technology involved.

Last night I was able to check some of the 'fortuitous' PAL TV signals coming from the new B1 high-power transponders, and the improvement over the old low-power transponders is very noticeable. Virtually gone is the remaining 'sparkle' noise on saturated colours, and the signal-to-noise ratio on the sound channels is greatly improved. This is with a 1.8m dish and 1.05dB LNB, by the way. I can quite believe that the professional broadcasting and communications users must be delighted with the enhanced performance and expanded capacity. This is quite apart from the new 150W L-band transponder on B1, which now provides the potential for a dramatic improvement in Australia's mobile radio communications.

With the B2 satellite due to be launched before Christmas, by the time you read this Australia should have all of the primary technology in place for a national satellite TV and radio broadcasting system, as well as a truly up-to-date communications network. So when you consider the enormous potential also rapidly developing in the area of photonics and optical fibre distribution, we really are entering an extremely exciting period of change in both communications and broadcasting.

Happily in this month's issue we have an interesting background story by Kate Doolan, on the development of the new Hughes HS-601 'next generation' satellites that are being used by Optus for its B series. I'm sure you'll find it as interesting as I did. There's also an intriguing story from Barrie Smith, explaining that while most of us will still have to wait for years to get Pay TV, our Japanese community and tourists already have such a service in operation every night...

Other features in the issue include the second of Colin MacKinnon's articles on the pioneering days of radar in Australia, and some new project designs that I think you'll find of considerable interest — including a low-cost adaptor which converts your PC into a digital sampling scope, and an updated version of our very popular economy 50MHz counter.

This month's review from Louis Challis is of Sony's new and incredibly tiny digital dictation recorder, the NT-1. This is the one we featured on the cover last month, you may recall, and Louis says that despite his experience with digital audio technology in general, he was almost 'blown away' by the performance delivered by this latest microscopic marvel.

By the way if you were one of those who were disappointed to find that we hadn't been able to include this review in last month's issue, please accept my apologies. Events conspired to prevent us including the review in the issue which carried the cover picture — sorry!

Jim Rowe

PAY-TV ALREADY HERE: NIGHTLY, IN JAPANESE

The rest of us may still be wondering when or even if we're likely to get the opportunity to watch Pay-TV, but Australia already has two such systems operating. The lesser known of these is TV Oceania, which broadcasts to Eastern Australia's Japanese community and tourists for three hours each evening.

by BARRIE SMITH

Some Australians still have difficulty with the apparent 'Japanisation' of Australia — most evident in Queensland, with Brisbane street names carrying Kanji along with the English script. And, of course we all 'know' that 99.99% of all hotels in that state are Japanese-owned. Or so it seems...

Less evident is the number of Australian businesses now operating which rely solely upon Japanese patronage. One of these is TV Oceania, operating with a staff of less than 20, from compact premises beside Sydney's Darling Harbour development.

'Coming soon'

Our PM declared on TV one Sunday morning that we would be watching Pay-TV as of some time in 1993. Then, as is often the way with such *ad hoc* declarations, the decision was reversed barely weeks later. Since then, Australia's Pay-TV future seems to have been debated almost weekly.

But few people realise that we already have Pay-TV — in limited form — via Sky Channel, which delivers wall-to-wall sport to the nation's hotels, TAB agencies and clubs. And, besides Sky Channel — with its foot also in the potentially lucrative technology door — is TV Oceania.

TV Oceania's ID, as transmitted to 36 hotels in Australia. Domestic installations were due to begin in October 1992.

TVO began as the brainchild of a pair of engineering consultants, Hank Prinz and Michael Thompson, who could see a niche market servicing the Japanese community in Australia. The pair had the RF knowledge and experience, but not the funds to get it all together.

However, commercial support was found and the business slowly moved off. Prinz and Thompson are no longer connected with the operation, which is now majority owned by Japan Travel Bureau — along with a holding by Japan Air Lines.

Operating since early 1991, the station currently compiles three hours per night of Japanese programming and delivers a 24-hour Teletext service in Kanji.

Three areas of the Japanese community are serviced: the tourist hotel trade, a corporate audience and (as of October 1992) domestic installations in Japanese-occupied homes.

The company's satellite coverage spreads from Cape York to Adelaide. It was expected the service would be linked with 15 - 16,000 rooms in 36 hotels by the end of last year, covering 80% of Japanese tourist arrivals.

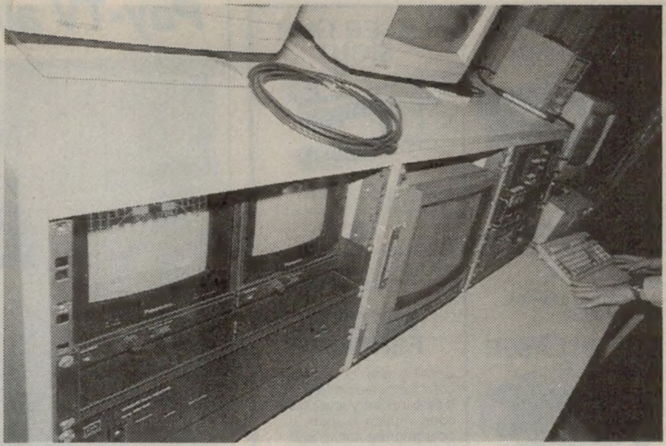
TVO's general manager John Martin explained how the hotel system works:

"The guest pays $10 for a 24-hour cycle — billed to their room account. This gives them access to two full-time channels in the Japanese language, as well as the normally available English language channels."

A major slice of the $10 is TVO's, with the hotel receiving a small proportion for their support and service provision.

Residential installations are arranged by the company contracting direct with the viewer: "We install the equipment. They pay an initial joining fee, a deposit and a monthly programming charge.

Master control at TV Oceania. A Sony switcher plus Betacam SP editing system are used in programme compilation.



The original NTSC signal is converted to PAL with a Tetra P165 standards converter and remains in PAL (via Thompson-CSF VideoCrypt) for uplinking to satellites.

We've done it this way because most of the Japanese viewers would be on 2-3 year contracts."

Twisted path

Although TVO is operational for only three hours each evening, when the second hand reaches 7pm nerves are a little strung in Master Control. At this precise moment the station switches from an ID graphic to the 'live' news feed, arriving from NHK's studios in Tokyo. There are many chances of an 'outage', due to the circuitous path the NHK signal follows.

According to TVO's chief engineer Peter Pratt, the original satellite hookup was direct with Tokyo: "NHK were uplinking a dedicated feed to us via a Pacific Ocean satellite, but this was a very expensive operation to have a dedicated transponder direct from Tokyo to here."

However, it was then found that NHK were also sending the same programme into the USA, where service similar to TVO's was operating.

This feed was being turned around in the States and redirected back out into Bangkok: "So we thought, why don't we get onto the Thailand feed and try and bring that in here. But then getting that across the Pacific and finding a spare transponder and someone who would carry it for us became quite a challenge, calling for much negotiation."

Pratt recounted the circuitous path NHK's nightly news takes: "Leaving Tokyo it goes via the Pacific Ocean satellite into the USA, then does a domestic satellite hop across the country, is picked up in Santa Paula in Los Angeles, back onto another Pacific Ocean transponder and down into OTC at Oxford Falls in Sydney.

From here, it travels on a terrestrial feed to Channel 10's control room, then back out to Belrose. From here it is turned around and comes in here at TVO, bouncing off an unmanned repeater en route — because we're in a bit of a hole here in the city of Sydney."

"We switch it into our programme — because we have leads into and out of the 'live' news cross. Then it's back out to Belrose and up onto the two AUSSAT Australian satellite feeds. We've got it located on A1 satellite, the other is on A3 satellite — two different transponders and not even on the same satellite!"

"Basically, that same live news programme, apart from all the terrestrial links, goes onto the Pacific Ocean satellite twice, onto a domestic satellite in the USA and then does two different satellites in Australia. So the poor old news service does a lot of travelling!"

The news from NHK in Tokyo, as received 'live' in Sydney. It travels over a particularly circuitous route.

"There are three transponders being used: A1 — TV only, which goes to SE Australia; A3 has the Teletext data which gets married to the TV programme in SE Australia.

There's also the NE Australian TV service — also on A3. Both the Teletext and TV are on the same satellite for the NE beam."

NTSC to PAL

When the Tokyo feed arrives at TVO, a Tetra P165 standards converter transforms the NTSC 4.2.2 standard to PAL, which remains in PAL from that point on.

The signal is then passed through the usual waveform monitoring functions and delivered to a Sony vision mixer. Externally sourced, but locally assembled tape is integrated with the Tokyo programming.

Programming includes variety, quiz shows, music, plus financial material such as the Nikkei business review. To this is added a topical Sydney studio news review.

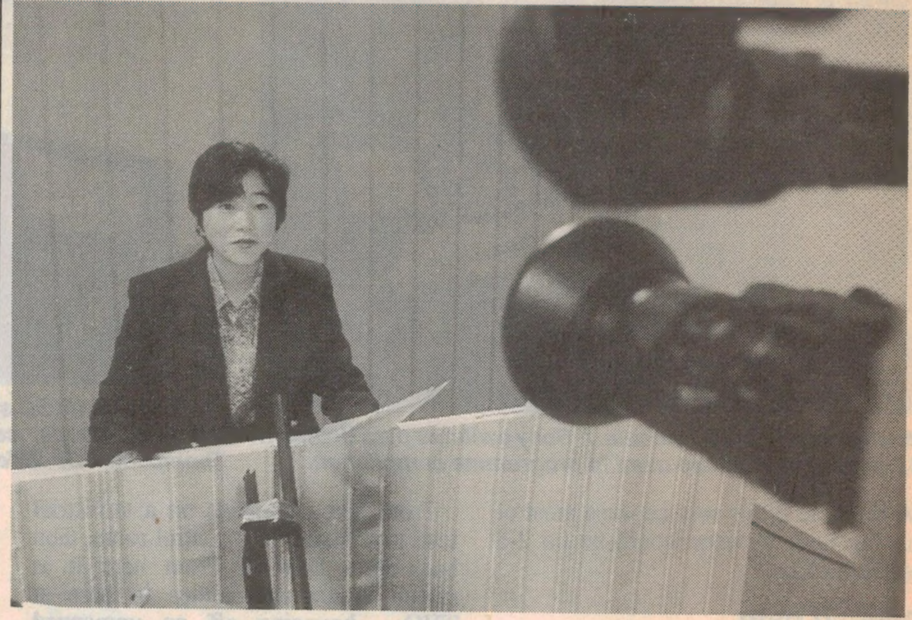
Leaving the vision mixer, the signal is passed through a Thomson-CSF *VideoCrypt* encryption system, PC driven. A scrambled picture leaves the Sydney facility.

A continual data feed arrives via a phone line from Kyodo news service. Input to a PC's word processor, this is printed out and sub-edited.

Local content — news, information, theatre programmes, etc — is added and the signal, as Teletext, goes back out on one of the audio carriers on the microwave path, then goes up on the FM-squared system on the satellite, allowing a data stream to be sent on a narrow bandwidth that runs 24 hours.

Says Pratt: "It took a while to get the software running for the word processor, because Japanese Kanji text characters total around 3000. This number does not fit nicely into the 256-character ASCII code, so we use a UNIX-based computer and 16-bit processor. Even the character ROM

Pay-TV already here: Nightly, in Japanese



A local news reader gives regular bulletins for interpolation into the NHK service.

in the receiver had to be specially developed.

"What the tourist has is a 24-hour service on his TV set. The timetable is made up of the live TV that we present each evening, recorded in the hotel for subsequent replay. This is switched into a number of tapes dedicated to the region. For example, in North Queensland we've got a small presentation: welcome to Australia; this is the currency, etc. That drops in five or six times during the day. Plus there's the Teletext information."

"Because the Teletext and TV services were operating on separate satellites, we had to develop a dual satellite reception system. So we have configured a special dish which covers the two satellites simultaneously — the two being set on 160° (A1) and 164° (A3) geostationary orbits."

The signal path presents the main operational difficulty. Notes Pratt: "The programme is going through so many links on the way here — if it stops, if there's an outage anywhere, we have to find the reason and prevent it happening again. Quite often, in our master control room, we 'hot switch' as the clock hits the 7pm mark."

'Narrowcast' licence

Australia's broadcasting legislation has escaped comprehensive revision since the early 1950's. However a new Act did pass through both houses of Parliament in 1992 — except for a section relating to Pay-TV.

Martin considers it a 'wonderful situation' where you have legislation, with Royal assent, that is in place, but refers in part to Section 7 (re Pay-TV) — which as yet isn't in the Act!

Normal national services are provided for within the legislation, along with community broadcasting and subscription services: "You can have narrowcasting and broadcasting subscription services. The main Pay-TV service is going to fall into the category of subscription broadcasting. That's the bit which is heatedly debated."

Martin's operation falls into a 'narrowcasting' category, because of their subscription basis. The constraints in terms of ownership and control of programming standards are the basic ones — no cigarette advertising, no R-rated material. As Martin understands the Act, 'narrow' applies if you are limited by one of a number of points: programming targetted to a particular grouping; programming directed to a special interest; or reception in a limited number of locations. As he sees it, his company's activities clearly fall within this meaning.

Future expansion?

It is arguable whether Pay-TV will be the bonanza some commentators foresee. From a national point of view it is difficult to contend with the view that a local operator, possessing the operational track record that TV Oceania obviously has achieved, should be allowed to participate in a wider coverage. ❖

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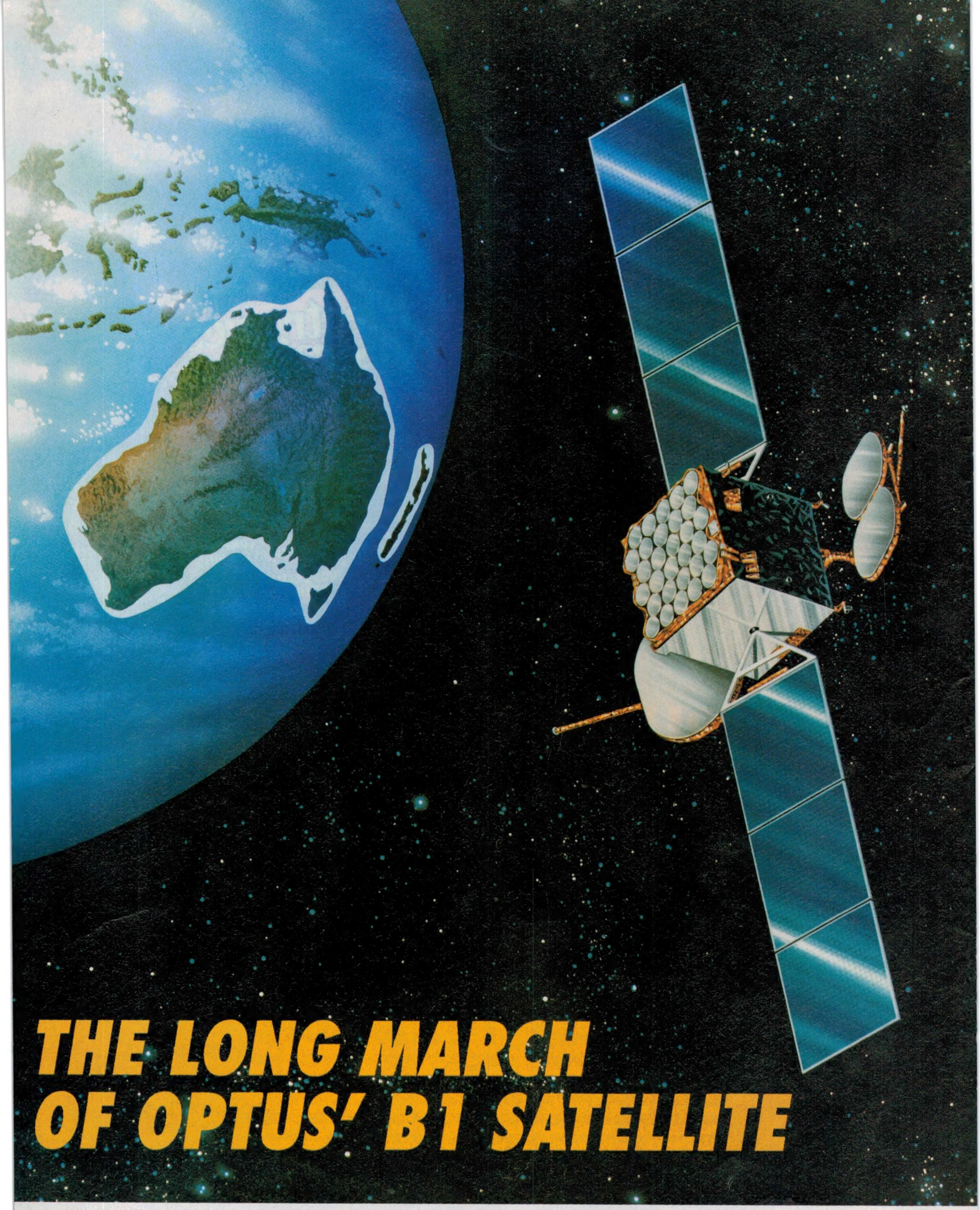


THE LONG MARCH OF OPTUS' B1 SATELLITE

There is an old Chinese proverb that a journey of one thousand miles always begins with the first step. For the new Australian owned Optus B1 satellite, that first step started in the United States and ended 36,000 kilometres above the surface of the Earth.

by KATE DOOLAN

The launch of the Optus B1 satellite in August 1992 was the beginning of a new era in Australian communications, which over the next 14 years will provide us with a variety of services such as the long awaited introduction of pay television.

The Optus B-series satellites are not Australia's first communications satellites to be launched into space, of course. In August 1985, the crew of STS 51I aboard the space shuttle *Discovery* deployed the first Aussat satellite (A1).

Three months later, the second satellite (A2) was deployed by the STS 61B crew and in 1987, the European owned Ariane rocket launched the third AUSSAT satellite A3.

In July 1988, AUSSAT signed contracts with the Hughes Aircraft Company in California for the purchase and in-orbit delivery of two new and higher powered 'B' series satellites. These contracts were worth $500 million.

The Hughes engineers designed a totally new concept for AUSSAT — the HS 601 satellite, which was based upon a *body stabilised* design, instead of the 'spinning drum' design that Hughes had used in all of their communications satellites since the mid-1960's.

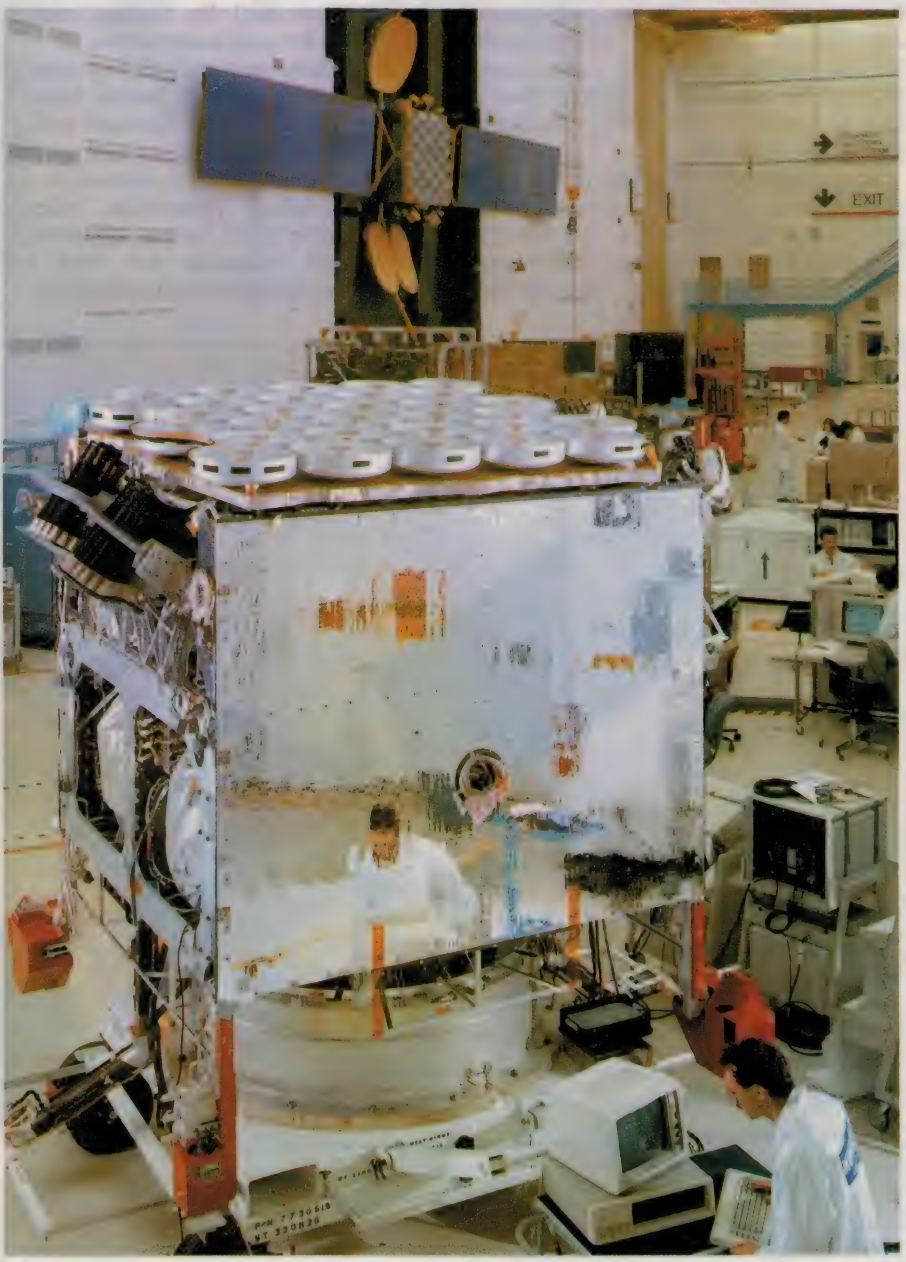
The new HS 601 satellites have a life span of 14 years, which is double the life of the first series of AUSSAT satellites. The HS 601 will increase the existing satellite communication network throughout Australia and will include direct television to remote communities, digital data transmissions and centralised air traffic control sources.

Each of the HS 601 satellites weighs 1582 kilograms at the beginning of its life in orbit. The satellites are a three-axis design comprising a cube-shaped central body, 2.29 metres on a side with a pair of three-panel solar array wings. Each of the wings is nine metres in length and has a post-deployment length of 20 metres.

A 30 element L-band antenna array covers the earth side of the satellite. An oval reflector on the eastern side of the spacecraft body and two smaller reflectors on the opposite side are attached to an 'A' frame structure which is similar to the AUSSAT A series satellites.

The three-reflector Ku-band antenna system provides eight transmit and two receiving beams in vertical and horizontal polarisation.

The Ku-band communications payload consists of 15 linearised transponders, each with an output of 50W and a bandwidth of 54MHz. The transmit coverage includes two national beams for Australia and the off-shore region, spot beams to all areas of the continent and a national beam to New Zealand. It will be possible to switch eight of the transponders to provide a domestic service to New Zealand, with services to and from Australia and New



The Aussat B1 communications satellite undergoes electronics tests in the satellite assembly facility at Hughes Aircraft Company in Los Angeles, California. The small cup-like antennas on top are the business end of the satellite's mobile communications capability. The arrays of dark conical objects near the top of the left hand side are Ku-band transponder feed horns, which ultimately aim at the reflector dishes.

Zealand. The effective isotropic power varies from 44dBW to 51dBW depending on the beams.

In addition to the Ku-band and L-band transponders, the satellites will carry two experimental payloads: a Ka-band beacon and a laser retroreflector. Both these experiments are located in the L-band antenna where they will have the required visibility of Australia.

The Ka-band beacon transmits a 28GHz signal in both vertical and horizontal polarisation for propagation experiments. The laser retroreflector will be used to provide the correct locations of the satellite, so signals from it can be used to set timing standards throughout Australia.

The spacecraft's electrical power subsystem uses the two solar arrays to generate up to 3200 watts of electricity. The three panel solar arrays are covered with silicon solar cells. Each of the panels measures 2.54 by 2.16 metres. A 28-cell nickel hydrogen battery provides power to the satellite whilst it travels through the Earth's shadow.

The satellite's propulsion system contains 1658 kilograms of monomethyl hydrazine and nitrogen tetroxide bipropellant, in four spherical titanium tanks which provide a minimum life of 10 years. A 490-Newton thruster is used for perigee augmentation and apogee burns. Thirteen 22-Newton thrusters are used for attitude control and station keeping manoeuvres.

An accurate antenna pointing control is supplied by an independent beacon tracking on each of the Ku-band reflector systems. The attitude control system uses an innovative combination of double-gimballed momentum wheels and magnetic field torque adjustment, which will minimise the need for thruster use during normal operations.

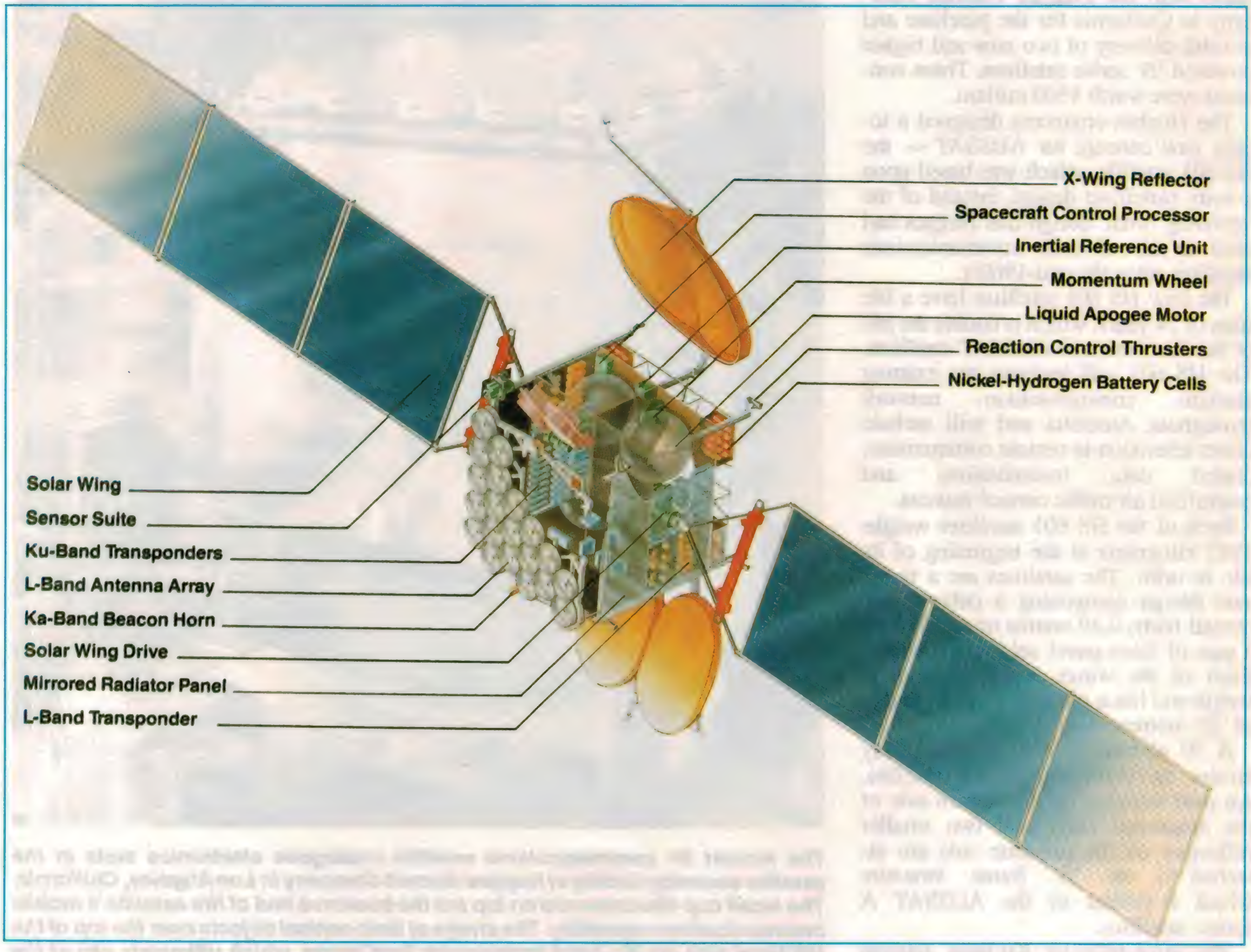
Although the satellite was primarily constructed in the United States, Australian companies supplied $30 million worth of hardware and services towards it.

Local companies involved with the construction included NEC Australia, British Aerospace Australia, MITEC and Hawker de Havilland. Australian insurance companies have also underwritten the launch of the satellites.

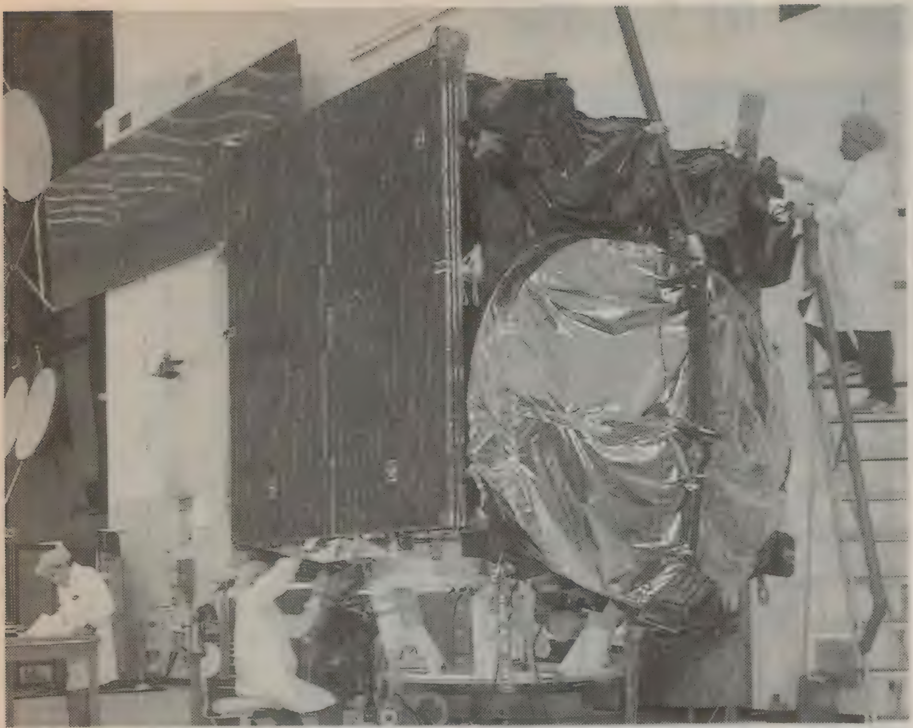
Following the acquisition of AUSSAT by Optus Communications in late 1991, the satellites were renamed after their new owners: Optus B-1 and B-2.

Launch vehicle

Hughes selected as the launch vehicle for Optus, the Chinese Long March 2E (LM2E) rocket. The LM2E is a derivative of the Long March 2 and 3 rockets that have been in use by China since 1974.



An artist's impression of an Aussat B series satellite with all of the main functional subsystems identified.



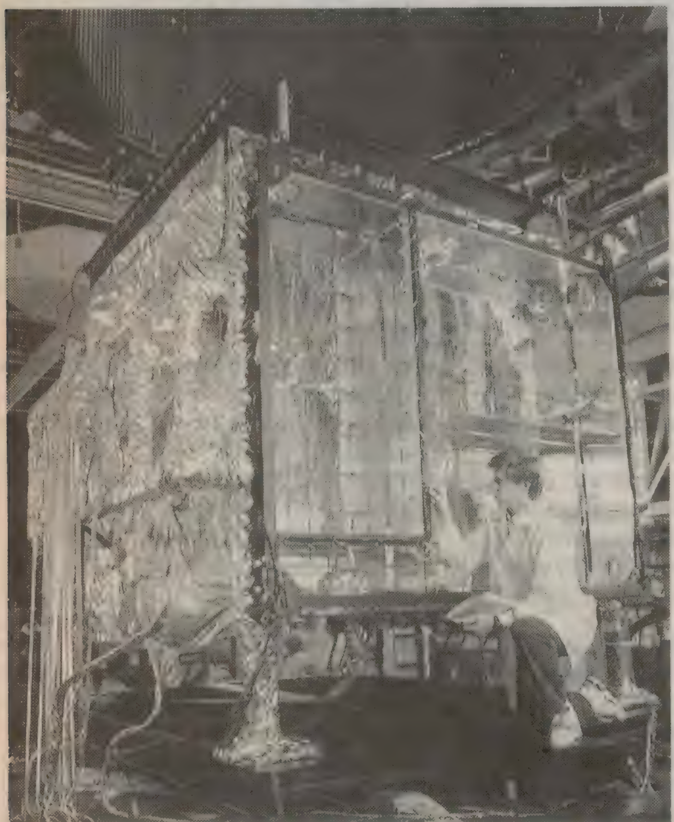
The Aussat B satellite is prepared for final testing as engineers and technicians attach thermal blankets to the spacecraft. The blankets are made of an aluminised film material that helps to balance temperatures throughout the spacecraft so that electronic and structural components will not be stressed by the extremely high and low temperatures experienced in space.

The rocket was designed and constructed by the Wan Yuan Industry Corporation in Beijing. The LM2E stands 49.7 metres tall, is 3.35 metres in diameter and weighs 464 tonnes; a seven tonne area is reserved for the satellite and upper stage. The lift-off thrust achieved by the rocket is 600 tonnes.

Before the satellites could be sent to China to be integrated with the launch vehicle, approval had to be obtained for the US-built satellites to be launched by the Chinese vehicles. US regulations prohibited the shipment of sensitive electronics equipment to communist-bloc countries, and United States

Congress had to approve the launch. Under pressure from the White House and various other government departments, permission was reluctantly granted in 1988 for the Chinese to go ahead with the launches. The American launch vehicle manufacturers protested vehemently over the decision, but they were ignored by the Reagan administration.

Following the Tiananmen Square massacre in June 1989, Congress imposed trade sanctions on the Chinese — placing the Optus launches in doubt. But the Bush Administration waived the sanc-



The mirrored surface on the side of this payload section of a new satellite for Australia will reflect and radiate heat away from the Aussat B spacecraft. The Hughes Aircraft Company test director checks connections to a heater array attached to the side of the spacecraft.

Engineers have built a development vehicle of the Aussat B satellite. This prototype allowed engineers to find potential problem areas in design and manufacturing before the flight spacecraft was built. The main body of the development vehicle is shown here being prepared for structural tests.

tions for the satellites, enabling the launches to take place.

However with the recent election of Bill Clinton to the American presidency, it is general knowledge that no more US-built satellites will be launched on Chinese or Russian rockets.

During the election campaign, Vice Presidential candidate Al Gore stated that the US should further develop their own launch industry and cheap, subsidised launches by those two governments would be prohibited.

Path into orbit

Following the launch, the Optus satellites begin a 10-day journey to reach their geosynchronous orbit of 36,000 kilometres over Australia.

Eleven minutes after launch, they are separated from the rocket. Two hours later, a Star 63 perigee motor is fired by a programmed automatic sequence.

The primary rocket motor lifts the satellite into a large elliptical orbit, with a perigee of 300 kilometres and an apogee of 36,000km. The rocket motor fires for two minutes and is later jettisoned from the satellite.

A liquid-fuelled second rocket motor is fired by command from the Optus Satellite Control Centre in Belrose, New South Wales. A series of controlled burns is then used to manoeuvre the satellite into its final position.

Once there, the satellite deploys its solar arrays and antenna arrays. The satellite is then tested for several months. The B1 satellite was expected to start commercial service from January 1993.

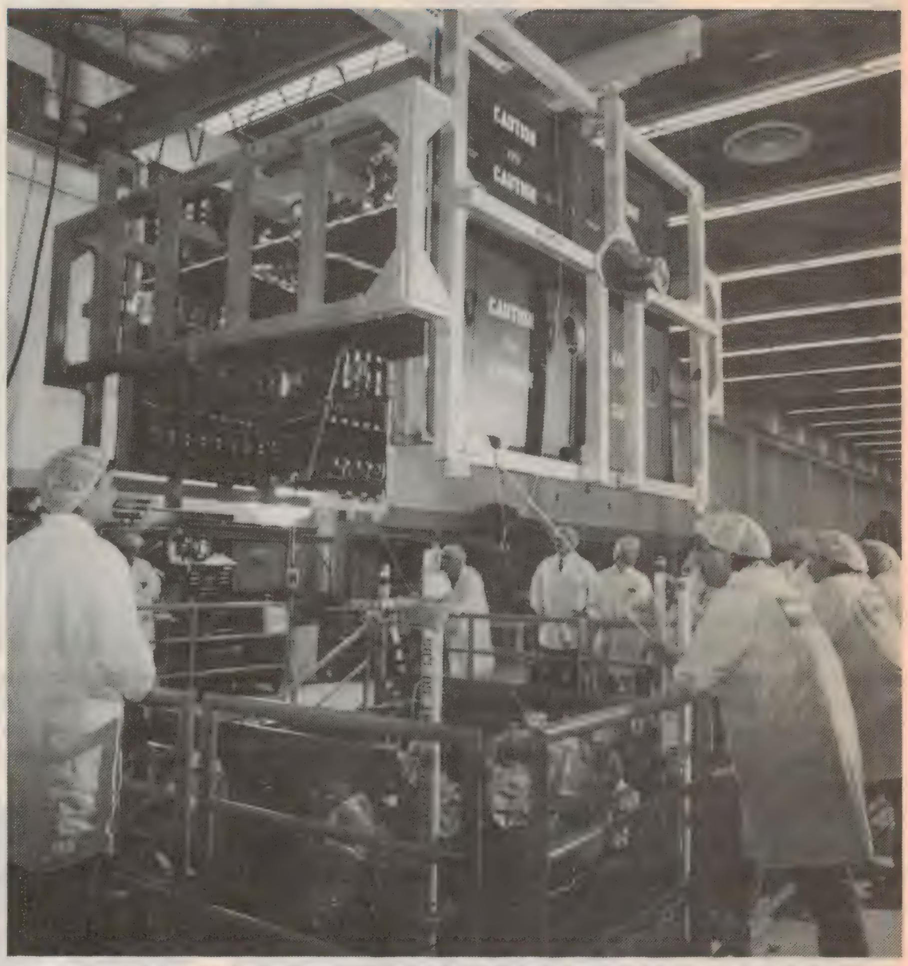
Initial fiasco

The launch of Optus B1 was originally scheduled to take place from Xichang, in the central western province of Sichuan in China, on 22 March 1992 at 8:38pm.

The countdown proceeded normally and the ignition sequence started with clouds of smoke appearing at the base of the rocket; but it did not lift off. Fire broke out, and was seen to be licking up the sides of the rocket.

Before the main engines had fired, safety mechanisms in the rocket had shut it down. Luckily the satellite, sitting at the top of the rocket, was not damaged. Shocked Chinese officials apologised for the accident and promised a complete investigation into what had happened.

The satellite was removed from the rocket and shifted back into the satellite processing facility, where it was stored until the next launch attempt was scheduled. It was expected that another launch attempt would be made in June.



The communications payload and propulsion section of the Aussat B-1 satellite are joined together. Shown here without solar panels or antennas, the spacecraft in orbit will stretch to 67 feet from solar panel tip-to-tip. It carries not only fixed communications service but also mobile service and is equipped with a 150W L-band transponder that permits mobile communications through small antennas mounted on cars, trucks and airplanes.

The cause of the failure was claimed to be the result of 'poor management'. It was said that officials had been negligent in conducting quality checks and had acted too hastily in preparing for the launch.

It was also revealed that aluminium debris had been found, which contributed to the shut down.

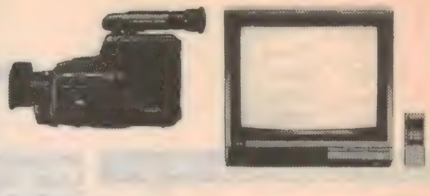
The launch of Optus B1 was eventually again scheduled for August 14, 1992. On that day, shortly after 9:00am (Australian time), a flawless launch occurred — making Optus the first Western satellite operator to have their payload launched by the Chinese.

The Optus B2 satellite was due to be launched in December 1992. Optus officials plan to move the A2 satellite into an inclined orbit, to lower the consumption of its fuel supply and extend its operational life. Optus B2 was to be placed into a storage orbit, where it will replace the A3 satellite in 1997.

These shifts were made to handle increased demand, and the routing of Australian and New Zealand telephone connections to an underseas fibre optic cable. With these changes, the new Optus satellites will be pulling Australian communications into the next century.

In conclusion, the author wishes to thank Leighton Farrell of Optus Communications and Emery Wilson Jr. of Hughes Aircraft Company, for their assistance in the completion of this article. Most of the photographs shown are reproduced by courtesy of Hughes Aircraft Company. ❖

What's New in VIDEO and AUDIO



Amstrad enters the hifi market

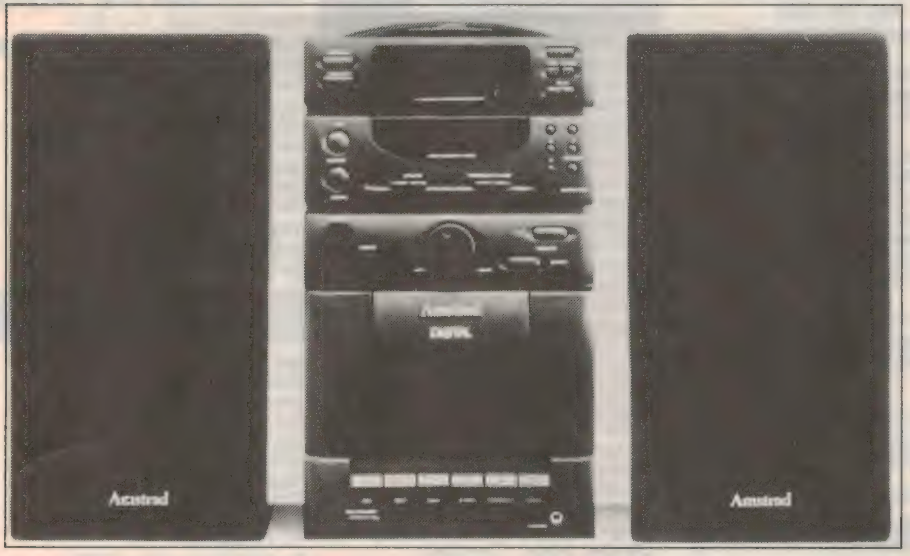
UK-based manufacturer Amstrad, well known for its aggressive international marketing in the personal computer and satellite TV receiver markets, and more recently for its dual-deck VCR, has entered the Australian domestic hifi market. Its first products are a pair of compact systems, with price tags pitched significantly below those of comparable products.

The new Amstrad systems are the compact 'Mini 2000' and the ultra-compact 'Micro 1000', priced aggressively at $499 and $399 respectively. Both consist of a pair of stackable electronics modules, in each case comprising a programmable CD player with a digitally tuned AM/FM stereo tuner, and a cassette deck combined with an amplifier; also included is a pair of speaker boxes and an IR remote control unit.

The 'Mini 2000' system has an output of 8W RMS, fed to two 105mm full range two-way speakers, and features a twin cassette deck, five-band graphic equaliser, 15-memory AM/FM tuner, 'super bass' LF boost facility and multi-function remote. The speaker boxes measure 410 x 205 x 118mm, while the electronics units are each 280 x 205 x 285mm.

The smaller 'Micro 1000' is a 5W RMS system, with single cassette deck, 10-memory AM/FM stereo tuner and separate volume, bass and treble controls and multi-function remote. In this case the speaker boxes measure 258 x 129 x 200mm, while the electronics units measure 150 x 129 x 200mm.

Both systems are designed to allow the electronics modules to be either stacked vertically or placed side by side, with the speakers also designed for either vertical or horizontal standing as desired.



Compact CD changer for cars

Panasonic has released what it claims is the smallest CD changer on the market in Australia. The ultra compact unit, known as the CX-DP60, can hold up to six compact discs and can be mounted under a seat, the dashboard, in the boot, glovebox or between car seats.

The changer has a 'super fast' access mechanism and a V/H switch, to allow easy installation either vertically or horizontally. MASH one-bit technology with 32-times oversampling ensures top sound reproduction. The unit is compatible with a number of radio-cassette models, but Panasonic recommends the most logical partner for it is the CQ-D55 because it can be plugged straight in.

Other suitable models to combine with the CD changer are Panasonic CQ-V15, which has more power and features and the top of the range CQ-V2303.

Dedicated outboard surround processor

Kenwood has introduced a dedicated surround sound processor, the SS-992 designed to be used in conjunction with existing hi-fi equipment. The SS-992 provides three amplifiers of medium power to the left and right rear channels (15 watts RMS) and centre channel (35 watts RMS).

The SS-992 boasts both Dolby Pro-Logic and Dolby 3-stereo plus a DSP Hall and Theatre mode that recreates the ambience of a concert hall and a live theatre. The SS-992 is designed to connect to your stereo amplifier via the tape monitor in/output circuits.

There is also a pre-out for rear left, right and centre channels, for use with other power amplifiers. There are three pairs of speaker terminals for left, right and centre channel. For the realisation of correct surround sound, Kenwood has provided an in-built test tone that the user can set for uniform surround between front, centre and rear speakers.

There is also provision to set the correct delay time for Dolby surround sound. The delay time can be varied from 15-30ms, to recreate the reverberant ambience most suited to the user's listening environment.

The SS-992 is covered by a three year warranty and has an RRP of $599. It is available at selected Kenwood A/V Concept dealers.

Sony 'Handycam' has image stabiliser

Sony has announced the latest addition to its extensive camcorder range with the Sony CCD-TR805, a top-of-the-range Hi-8 Handycam Traveller featuring the newly developed 'Steady Shot' image stabiliser.

The 'Steady Shot' image stabiliser is based on an optical system, which differentiates it from competitive brands that use electronic stabilisation systems.

In the CCD-TR805, built in vertical and horizontal sensors control motors which change the angle of the active prism lens, whenever the camcorder is moved.

The CCD-TR805 is also the first camcorder in the Sony Traveller series to have a data code system. The data code records

the date and time of recording which the user can choose to display if required and is ideal for cataloguing the video tapes.

The CCD-TR805 features 10x power zoom with two speeds, precision CCD (470,000 pixels), full range auto/manual focus and stereo AFM hi-fi recording capability.

It carries an RRP of $2999.

Panasonic launches 'The One Up' CTV's

Panasonic hopes that the addition of slim dome sound and artificial intelligence (AI) control circuitry ensure that its new large screen CTV range, The Big One, will be even more popular than its predecessor.

Claimed to produce more than 800 lines of horizontal resolution, the One Up series delivers pictures in fine detail. Panasonic has also narrowed its speaker system to a third of its previous design width, to create 'slim dome' sound on the 68cm and 78cm models.

Other features common throughout the range include broadcast stereo reception, computer controlled Teletext (built in or adaptable), multiple AV connections, AV menu and memory, multi function remote, on screen indicators and VCR/game mode for improved reproduction of irregular signals from sources such as TV games and rental videos.

The top of the range model TX-33V30X also features picture-in-picture and World 21 receiving system. The new models designated TX-33V30X, TX-29V30A/TC-29V25A and TC-25V25A, are claimed to be the most compact on the market.

High quality 21" stereo CTV from Akai

Although there has been a marked increase in the popularity of large screen CTV's (25" and above) in the surround-sound 'home theatre' market, the 21" screen gained greater CTV market share during 1992 — perhaps due to the advent of flat square picture tubes.

Designed for either the home or office, Akai's new CTK-2175 incorporates a 40-memory stereo tuner, and is designed to receive both VHF and UHF terrestrial transmissions.

To take advantage of its quality stereo tuner, the unit has an inbuilt 10 watt stereo amplifier with quality speakers situated either side of the screen.

The CTK-2175 also features a SCART video/audio input, allowing connection to VCR and stereo units directly with RCA connectors.

A 40-button infra red remote control enables armchair control of all the CTV functions including channel selection, volume up/down, balance and Teletext information.

The CTK-2175 is covered by Akai's 12-month parts and labour warranty. It has a recommended retail price of $899 and is available at selected dealers and department stores.

New monitor speakers from ATC

Not too many speaker manufacturers can lay claim to being the preferred speaker suppliers to such artists as Julio Inglesias and John Williams, also to leading world amplifier designers Dan Angustino of Krell and Flemming Rasmussen of Gryphon. Nor to having their systems installed in such venues as Sydney's own Opera House, the BBC, the Royal Opera House Covent Garden and Warner Bros.

The Acoustic Transducer Company of Gloucestershire, England, better known as ATC, can in fact claim credit to installing its speaker systems to these venues, as well as hundreds of other recording studios, broadcast stations throughout the world.

Founded in 1974 by Australian born acoustics engineer and professional musician Bill Woodman, ATC has been steadily improving its market share in both the professional and high end consumer market.

More recently, through its Australian distributor, AR Audio Engineering, ATC has embarked upon the introduction of the SCM-series monitors, the SCM-100A and the SCM-50A.

Both speaker systems are a tri-amp design with the SCM-100A boasting a 100 litre enclosure and using a 12" bass driver, while the SCM-50A is more compact and uses a 50 litre enclosure and a 9" bass driver. Both systems are available in hand sealed wood veneers finished in satin lacquer and waxed to an extremely hard finish.

The active crossovers and power amplifiers are designed by ATC, and incorporate a very high bandwidth, electrically balanced input stage. Power amps are all MOSFET design and each is matched to each particular drive unit to ensure the system has a balanced maximum sound pressure level capability. The SCM-Series can be played at very high levels, approximately 350 watts and need only a quality preamp to drive them.

Both the SCM-100A and the SCM-50A are covered by a five year parts and labour warranty and have a recommended retail price of $18,250 and $15,700 respectively. Other ATC models start from $2999. For further information on the above and other ATC models please contact AR Audio Engineering Pty Ltd on (02) 299 3666. ❖

SONY'S NT-1 'SCOOPMAN' DIGITAL MICRO RECORDER

This month, Louis Challis was able to run his instruments over the new Sony NT-1 digital micro recorder, as featured on our front cover last month. We're sure you'll find his report makes very interesting reading, not only because of the NT-1's incredibly tiny size, but because of the undoubtedly state-of- the-art technology it embodies — and the performance it delivers...

Following our review of Sony's TCD-D3 DAT Walkman Recorder (June 1992), I was intrigued at the number of friends and even acquaintances who singled me out to recount their interest in that particular review. I now suspect that a somewhat different *genre* of friends and possibly clients will advise me of their interest in this month's review, as digital micro recorders offering the power and the potential of Sony's Scoopman, will undoubtedly evoke even greater interest.

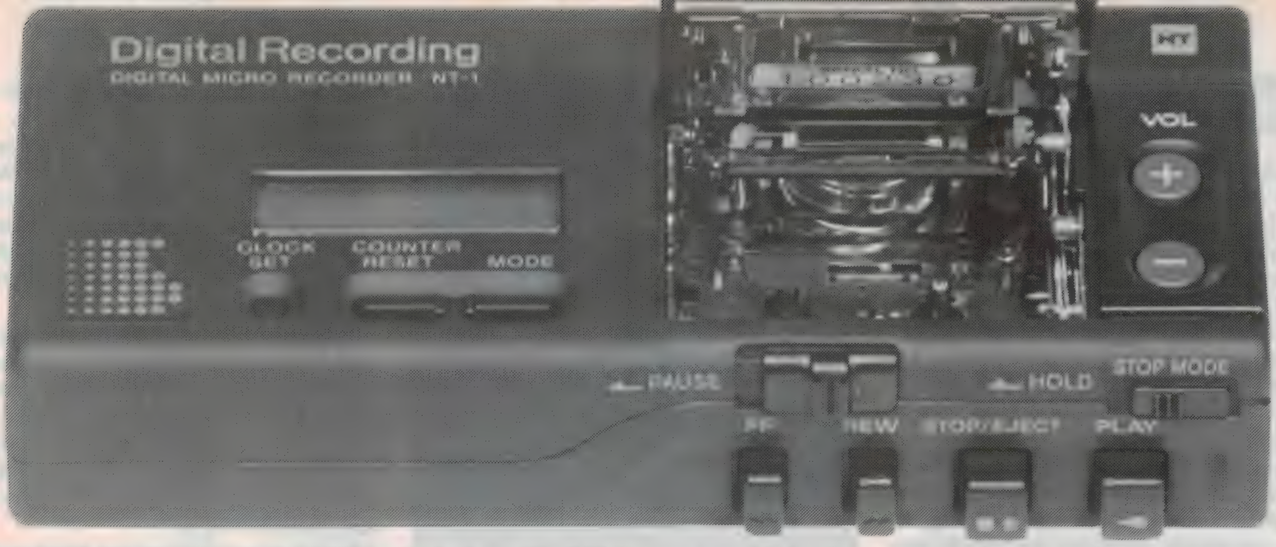
There are of course, some excellent miniature tape recorders already on the market as there has been a great demand for such recorders, a considerable proportion of which has been generated by 'law enforcement agencies' who have either promoted and/or provided development funds for some of the most sophisticated small tape recorders in the past. One of the best of those recorders, which few people know about, was the Kudelski Nagra model SN recorder, and which was used by the Australian Federal Police, ASIO, and many others because of its reliability.

Unfortunately the Nagra SN had dimensions similar to those of a small cigar box, and whilst it was initially popular, I have no doubt that their bulk and their limited recording capability proved to be both an embarrassment, and I suspect a source of danger for their users on many occasions.

There have been plenty of other players in the field who have wanted and have even funded the development of such recorders, for whilst the field of 'law enforcement' is one obvious area of use, the linked fields of espionage — and counter-espionage — are even more compelling, and the firm that can develop a sub-miniature recorder with true hi-fidelity performance and the ability to record four hours, rather than minutes, has the markets proverbially sewn up!

Enter Sony, with its development of the NT-1 Digital Micro Recorder.

Sony's interest in the task of micro-miniaturising tape recorders was a natural outcome of their pioneering developmental work on the Sony 'Walkman' and a range of other prototype recorders, the majority of which were stillborn in the laboratory, axed by top management's review committees.



Somewhat larger than actual size, this shot shows the NT-1 recorder with its tiny cassette bay open. You can just see the head scanning drum at the back of the bay. The drum is only 14.8mm in diameter, with a width of only 4mm so that it can move forward into the loaded cassette.

One important reason why this new recorder has seen the light of day is that Sony has been extremely reluctant to back Philips' DCC philosophy of fixed multi-head cassette recorders, in preference to the well proven, rotary-head tape recorder concepts — an area in which Sony has consistently lead the pack in its R&D Department, and through which it has developed both innovative and practical recorders over the last 15 years.

Miniscule cassette

One of the least surprising features of the Scoopman Micro Recorder is its use of a pre-packaged cassette format, whose minuscule size puts the cassettes alone into an award winning class.

With face dimensions of only 30mm x 21mm, these micro cassettes are a fraction of the size of any previous cassette tape module. Quite apart from being appropriately described as having 'postage stamp' dimensions, I fear that these small cassettes would in many situations constitute a vision hazard, as they are so small that they are likely to be readily lost or misplaced.

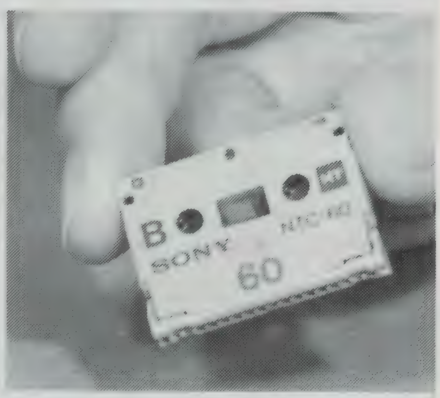
Although available in 60-minute, 90-minute and 120-minute versions (did I hear you gasp?), the NT micro cassettes are only 5mm deep. Their size is put into sharp perspective, when you find that their volume is only 1/25 of that of a conventional audio compact cassette. They are so small that Sony applied to the Guinness Book of Records for formal recognition that their development warranted an award. Not surprisingly the Guinness people decided to create a new classification, with of course Sony being the recipients of the first award.

Rotary vs. fixed heads

Many aspects of Sony's digital micro cassette recorder technology are spin-offs from their prior research in the digital audio domain. Sony have expressed the strongest of views that rotary head recording techniques provide a superior method of maximising magnetic tape's recording data density (quite apart from the reliability factor).

This is in stark contrast to the Philips position, and their relative positions have been so polarised that Sony have refused to back the DCC recording concept.

Of course by now, most readers are aware of the significant advantages that the digital approach offers, in terms of the elimination of background tape hiss and the ability to provide two relatively wideband (stereo) channels. Depending on the digital data's sampling rate, the system can also offer enhanced audibility for music or complex signals, quite apart from its outstanding speech intelligibility potential. Provided the system uses advanced high-density recording techniques, coupled with advanced LSI circuit technologies, a digital micro recorder can achieve unprecedented miniaturisation coupled with an unparalleled data density on the recording media.



The NT-1's tape cassettes measure only 30 x 21mm, and use tape only 2.5mm wide. Yet the cassettes provide 60, 90 or 120 minutes of recording, by using half the tape width one way and half the other — with helical scanning!

By now you must have realised, that this is precisely what Sony has accomplished with the NT-1 Digital Micro Recorder. Its remarkable digital microcassette philosophy completely redefines the term 'micro recorder', and the new NT-1 digital cassette format can provide up to two hours of ultra-low noise digital stereo recording — noting of course that to achieve the two hours recording time requires the cassette to be turned over.

Whilst not necessarily out-performing DAT cassette recorders, the NT-1 system nonetheless gives those DAT recorders a 'mighty good run for their money'. One aspect of the design that really caught my imagination was the NT-1's ability to operate for *seven* (7) hours of recording time, on a single 'AA' alkaline battery! That is of course phenomenal, but it is time I told you how the NT-1 works and how it achieves its extremely high recording density.

Changes inside

First of all, the NT-1's recording format uses the now familiar rotary head, double-azimuth helical scanning system. The NT-1's implementation of that system, however, represents a radical departure from the conventional rotary-head designs used in your residential VCR or even in the latest DAT recorders. Because of the diminutive size of the digital cassettes, the designers have had to adopt an entirely new approach to tape loading and also to the rotary head tracking on the tape.

With a conventional rotary-head system, the transport includes a loading mechanism that withdraws the tape from the cassette shell and then wraps it around a portion of the head drum. The conventional VHS video, or 8mm video, and even the latest DAT recorder mechanisms all employ some variation of this technique.

THE CHALLIS REPORT

The basis of the mechanical system that each of these prior systems used were (and are) particularly complex, as the tape had to be handled with extreme precision, and as you may have discovered if you weren't careful, with even greater care. The standard video tape cassette recorder designs were not particularly space-efficient, because a significant area in front of the cassette had to be set aside to facilitate the tape wrapping procedure.

Now it is not readily possible to reduce the size, weight or the cost of a conventional rotary-head system to any great degree. This complexity becomes even more embarrassing because of the way that the tape wrapping mechanism inhibits your ability to load or eject a cassette when the power is disconnected.

The NT-1 adopts an entirely different and very novel 'non-loading' system to solve these problems. Fig.1 shows how Sony's engineers avoided the need to withdraw the tape from the shell. The tape wrapping mechanism is accomplished by inserting the head drum assembly into the front opening of the cassette shell itself, which has moulded tape guides serving the same function as the inclined and vertical guides in conventional rotary-head system.

The cassette shell also incorporates pressure rollers, thereby ensuring that the head drum and capstan are the only external elements which need to be engaged by the cassette. Since tape travel is fully contained within the cassette's body, the 'non- loading' system provides the high-density recording benefits of a rotary-head design, while preserving many of the most important features of simplicity and space-efficiency offered by conventional fixed head mechanisms — of the type that have been adopted for conventional compact cassette as well as for existing micro cassette recorders.

Whilst the mechanical features are innovative and unquestionably effective, the real basis and most outstanding feature of the NT format is Sony's innovative 'non-tracking' system.

The nomenclature NT was in fact derived from the words 'Non Tracking', and by adopting this almost 'way-out' technique they have been able to achieve higher recording density through the use of shorter wavelengths, thinner tapes, and much narrower recording track widths.

As you can most probably appreciate, the narrow track width requirement posed many serious and very disturbing fundamental hurdles, which had to be bridged. With such narrow track widths for both writing and subsequently reading the digital data off the tape, the question of data integrity and its preservation would have been potentially severely compromised by

At the end of the NT-1 recorder's case the headphone and microphone sockets, plus a tiny Record button.

the slightest imprecision in tracking. Even if the recorder was able to track its own tapes, the question of unit-to-unit compatibility became yet another difficult issue in its own right.

These problems were further compounded by the limited practical tolerances in the NT cassette's built-in tape guides, as well as by the extremely short length of exposed tape with which the 'non- loading' system is forced to work. The problems became so severe and so compromising that in the end the conventional tracking systems had to be discarded, and a brand new, and as you will soon agree, a clearly revolutionary approach had to be adopted.

The stumbling block of data tracking could only be resolved by abandoning the traditional approach, which is based on a high- precision servo control. The non-tracking playback method employs a double-scanning procedure, combined with a high-speed memory to accurately read all of the recorded data — and thereby provide a mechanism through which innovative *software* then solves all of the hardware problems.

By discarding the conventional tracking precision requirements, the NT system eliminates the need for fixed control heads and automatic track finding circuitry. This then made the entire recording system much simpler, and as a consequence considerably smaller than the conventional alternative.

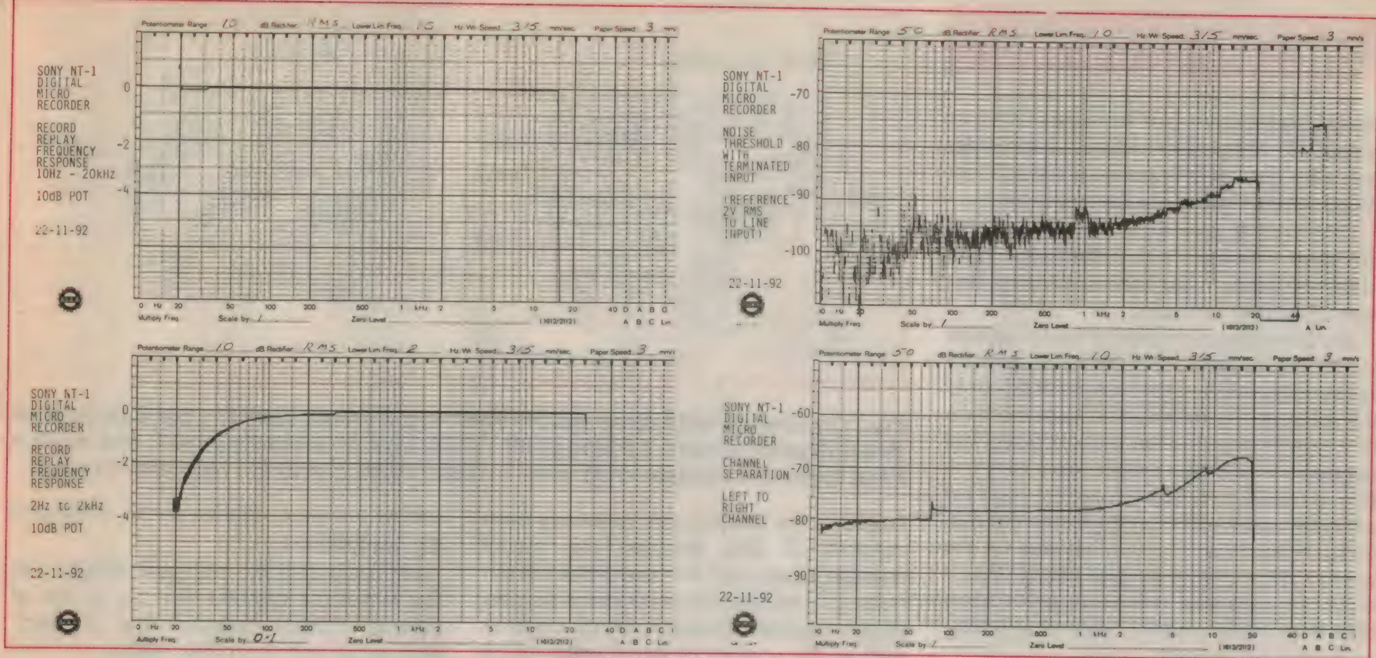
In a conventional rotary-head system, there must be a one-on-one tracking correspondence between record and playback. That tracking correspondence is a fundamental requirement, since the two rotating heads with opposite 'azimuths' alternatively lay down successive tracks during the recording cycle, and each track must be similarly traced at precisely the same angle by the corresponding replay head during playback. If this procedure is imprecise, mistracking occurs and of course data (or in the case of a VCR the video signal) is lost.

By contrast, when the non-tracking playback method is adopted, the one-on-one tracking correspondence with the recorded tracks is intentionally altered. The speed of head drum rotation is *doubled*, and this results in a double-density scan. Because the tape speed remains the same however, the actual path traced by the heads during playback cycle is far steeper, as shown schematically in Fig.2.

This non-tracking replay procedure is

Measured performance of Sony NT-1 Digital Micro Recorder
Serial No T49017801489809

Frequency Response			10Hz to 14.5kHz		+/-0.1dB	
			2Hz to 14.6kHz		=/-3dB	
Dynamic Range			75dB unweighted			
			80dB (A)			
Channel Separation			20Hz	-80dB		
			1kHz	-78dB		
			10kHz	-70dB		
Wow and Flutter			Immeasurable			
Harmonic Distortion (1kHz)		Input/Output Line)				
	Level	2nd	3rd	4th	5th	THD
3.0V		-70.3	-68.7	-74.7	-	0.12
2.0V		-72.2	-71.0	-74.1	-85.4	0.10
0.5V	0dB	-73.6	-70.7	-75.1	-	0.09
	- 2.0	-76.3	-71.2	-75.7	-	0.07
	- 4.0	-81.5	-72.5	-77.1	-85.3	0.06
	- 6.0	-84.2	-73.5	-76.9	-	0.05
	-10.0	-	-77.9	-80.9	-	0.03
	-20.0	-	-	-75.2	-73.2	0.04
	-30.0	Below	Noise			



Measured performance curves for the Sony NT-1. At top left is the record replay frequency response from 20Hz to 20kHz, with the low end (2Hz to 2kHz) response expanded below. At top right is the noise threshold with terminated input, from 10Hz to 20kHz, and finally the left to right channel separation.

then able to read all of the recorded data, despite the skewed head path. Thus by way of example, the output from head 'A' is able to make four scans (1 to 4) at double speed, and the demodulated RF output of the digital signals results in data strips 1 through 4 corresponding to the four scans. (See Fig.3, although only 25 data blocks are shown in this illustration for simplicity, as each track actually incorporates 104 data blocks.)

If we focus our attention on the data contained in track A, we see that each of the data strips 1 - 4 contains only part of the information on the track, with a certain amount of overlap interspersed among track A's blocks of data from those on the other tracks.

Potential errors and loss of blocks of data occur whenever head 'A' tries to read data from a track recorded by head 'B', because of errors in azimuth positioning and other discrepancies. In theory, and normally in practice, four head scans contain all the data blocks necessary to fully reconstruct track 'A'. The information collected is totally out of sequence, however, at this point of time.

The out-of-sequence data is fed into a high-speed buffer memory, and by adopting a random access sequential reading of the recorded data, it is then re-compiled into the correct order. At this point I'd like you to give a few moments thought as to the complexity of the micro-processing LSI hardware necessary to implement this task in *real time*.

The information from the replay heads is written sequentially into the buffer memory. The memory contents are then read out with timing controlled by a quartz reference oscillator, and the data is then rearranged and error-corrected prior to its digital to analog (D/A) conversion. The question that you will obviously be asking is 'How does the system know, seemingly in advance, the correct position in memory for each block of data block, especially if multiple overlaps occur?'.

This is apparently achieved by subdividing the data into quite small blocks during recording, and identifying each block with a unique address code. The individual blocks are then not unlike pieces of a jigsaw puzzle, and their addresses allow the replay circuitry to re-arrange them back into their correct sequence in the recorder's dynamic buffer memory — which is continually being updated as the replayed data continues to be fed into it.

Of course, errors in tape speeds can cause discrepancies between the rate at which data is written to the memory and the rate at which the data is fed out of the memory. Under these circumstances, there can be either an 'overflow' or an 'underflow' of data and in precisely the same way that any data streaming system requires some form of feedback element, this system uses a tape servo control system to regulate the tape speed.

Other unusual features in the system are the adoption of an ultra-high-precision miniature recording drum, with a minuscule diameter of 14.8mm incorporating slanted cuts and with an unprecedented width of only 4mm. This is further complicated by the narrow tape width of only 2.5mm, and a system which only records on one half of the tape — i.e., a total track width of approximately 1mm!

Ensuring proper playback of the RF signal output thus becomes a prodigious problem, because of the narrow tracks, short recorded wavelengths and the relatively slow head to tape scanning speed.

The miniature drum in the digital micro recorder is driven by a direct drive motor of minuscule proportions, which faces considerable problems in terms of 'low torque' and reasonably low efficiency. With dimensions as small as these, tolerances become super critical, as even the slightest deviation in the position of the angle sensor results in significant errors in terms of signal output.

12-bit coding

The NT format uses a 12-bit nonlinear quantisation to encode the audio signal, which provides a dynamic range which Sony claim is theoretically equivalent to a 17-bit linear quantised signal — but offers a superior signal encoding efficiency. Sony claim that it provides a dynamic range of over 86dB, with a sampling frequency of 32kHz.

We were able to confirm an 80dB(A) dynamic range, and had difficulty finding out what happened to the other 6dB. The sampling frequency of 32kHz results in a flat frequency response from 10Hz to 14.5kHz. We measured a slightly better response than that, but once the frequency response is as smooth and as flat as that, there is little justification in extending it further.

Among the other technically innovative new developments in this recorder are the development of a new modulation technique, the development of a new double-

sided cassette that can be turned over to record 60 minutes of data on each side, and a bi- directional cassette lid which can hinge symmetrically in either direction.

When the lid opens, the correct elements are then activated within the cassette to allow the rotary head helical scanning system to operate correctly.

Another unusual feature of the NT system is the development of a metal evaporated active magnetic surface tape, which is only 0.2 microns thick compared with the 3um of a conventional metal particle tape. The magnetic deposition method uses an ultra-thin aramid film which avoids the need for a binder, and thereby produces the thinnest and newest 'hi-tech' recording tape on the market. This tape is so outstanding, that it offers the ability to over-write pre-existing data with 100% erasure, without requiring a separate erase head.

Another advantage of the metal evaporated tape coating is that the unit magnetising length (i.e., half the shortest recorded wavelength) is greater than the thickness of the magnetic layer, and as a consequence of which self-magnetisation ceases to be a problem. In like manner, the higher magnetic material density ensures higher remanence, higher output levels and a markedly superior carrier-to-noise ratio.

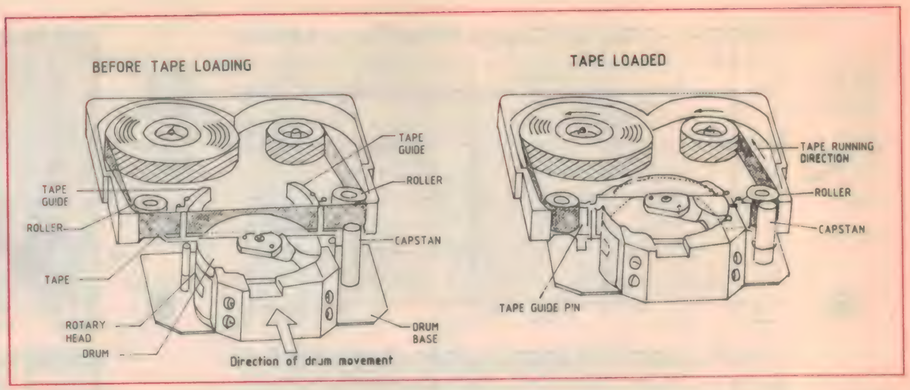


Fig.1: In contrast with other helical-scanning systems, the NT-1 uses no special threading mechanism. All tape guides are inside the cassette intself, and the tiny head drum and capstan move over to make contact with the tape after loading.

Six LSI chips

The NT-1 incorporates six LSI chips, which contain the equivalent of 1.8 million transistors. These chips are firstly a DSP chip, which contains the digital over-sampling filters for the 'A-D' and 'D-A' converters, error correction and concealment code encoders, decoders, modulators, demodulators and the non- tracking processing circuitry. It also is used in conjunction with the external 1-megabit dynamic RAM chip, which provides the associated non-tracking and servo buffers.

The second largest chip is the ADA chip, which contains the A/D and D/A converters together with all their associated analog and digital circuits. The third chip is the DET LSI chip, which contains the digital circuitry for playback RF equalisation, phase-locked loops and associated functions.

The fourth chip contains the DRV circuitry, which includes the DC/DC converters, the power supply regulators and motor drive circuitry. The fifth chip is the Micro CTL, which contains the microprocessor, which performs the calculations for the motor servo control, the system control and the LCD readout function. The sixth chip is the R/P IC, which contains the RF record and playback amplifiers.

All of these LSI chips are controlled by a simple serial bus, whose novel architecture facilitates the exchange of unusually large volumes of data between the central microprocessor and the associated LSI circuits. This architecture reduces the number of pins required on each of the LSI chips, as well as the number of signal paths which the circuit board must provide.

All of this circuitry is mounted on one unusual flexible printed circuit board, which facilitates the folding of the board so that both the chips and the associated mechanical and input or output elements, usually remotely located, can be mounted directly on the board.

This board is then twisted or folded as required to facilitate appropriate positioning of the components. This in turn achieves a dramatic reduction in the number of wires, and more importantly the interconnections — any one of which can lead to unwanted noise and related reliability problems.

The NT-1 has two components, a main unit and an adaptor unit. The main unit has four primary control buttons on the side of the recorder which are respectively FAST FORWARD, REWIND, STOP/ (CASSETTE) EJECT, and PLAY. Immediately above these is a mechanical PAUSE switch, and a separate small button which is the STOP MODE or (HOLD) switch. At the end of the recorder is a indented minuscule RECORD button, and a pair of miniature sockets for the self-powered microphone jack, and a similar miniature tip/ring/sleeve socket for the headphones.

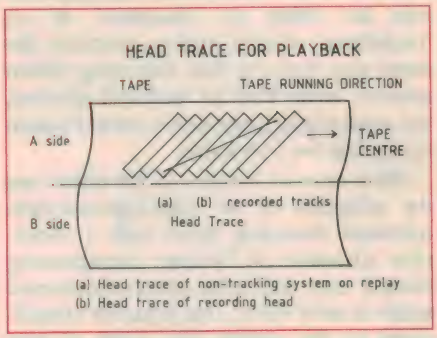


Fig.2: During replay, the NT-1 heads scan the recorded tracks at double the original recording speed.

On the face of the main unit, adjacent to the minuscule cassette well are a pair of volume control buttons, one marked with a '+' and the other with a '-'. This concept, although common on other equipment, was obviously the only way of avoiding a conventional volume control potentiometer. There are only three other controls, which are a CLOCK SET button, a COUNTER RESET button and a display MODE button, which control the small LCD display on the front face of the main unit.

The adaptor unit is almost phallic in its characteristics, as to use it and effect the connections required for external powering of the recorder, and to facilitate external monitoring (which requires separate 'LINE IN' or 'LINE OUT' output jacks, as well as providing RECORD/MONITORING facilities), the battery has to be removed, and the extended tubular element on the adaptor unit inserted into the empty battery compartment. Inside the battery compartment there are a series of gold-plated connectors, with which contact is then made, and through which these additional facilities can then be simply provided.

My initial concerns were that if the 'AA' battery were to leak, you would prejudice the integrity of those minuscule gold-plated contacts and would either have an unhealthy repair bill, or face some other traumatic problems.

Objective tests

The objective testing of this unit presented few problems, although those that were encountered are worth relating.

The frequency response is exceptionally smooth, and most certainly every bit as good as claimed by Sony. The lower 3dB point is a shade over 2Hz, and the frequency response from 10Hz to 14.5kHz is within +0 and -0.1dB. If only the microphone were that good! As the upper frequency response of the microphones supplied are unlikely to be any better, let

alone nearly as good, there is little justification for improving on the recorder's performance.

I measured a -80dB(A) noise figure, which was -75dB unweighted relative to a 2V line input signal, and I was impressed by the uniformity of the one-third-octave band noise spectrum threshold.

The measurement procedure was affected by the action of what appeared to be an AGC circuit, which came into play during the measurement sequence. This same AGC type response also impinged on the channel separation measurements, and shows up on the trace of left channel to right channel separation.

My assessment of RECORD to REPLAY linearity was severely prejudiced by the action of the AGC circuit, which was so effective that we gave up trying to measure the linearity, as we were definitely in a 'no-win' situation. By contrast the harmonic distortion characteristics of the unit were exceptional, at recording levels all the way from quasi 0dB down to -30dB — by which time the distortion components were below the noise threshold and thus immeasurable.

I tried to measure the wow and flutter, but using a conventional meter these were also immeasurable. The same signal fed to a FFT analyser resulted in a narrow band signal, which was indistinguishable from the original input signal fed to the NT-1's line input socket.

Apart from the impact of the (presumed) AGC circuitry on our measurements, the objective testing of the unit was absolutely uneventful, because the measured results were so good.

Listening tests

I progressed to the subjective testing, and was astounded by the quality of the audible signal. I recorded a series of new CD's using the line input docket, the first of which was Beethoven's Piano Concertos Nos. 3 & 4, with Murray Perahia and Bernard Haitink conducting the Royal Con-

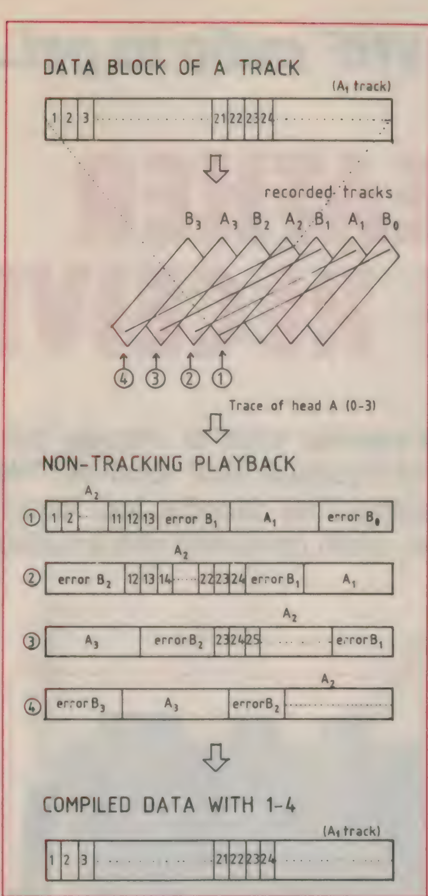


Fig.3: The 'non tracking' replay system delivers the recorded data in jumbled order, but the software rearranges it back into the correct order.

certgebow Orchestra (Sony SK 39814). Then I lined the CD up so that its output was four seconds ahead of the replayed output of the NT-1, so that I could carry out 'A-B' comparisons.

As hard as I tried, even with the reduced bandwidth of the NT-1, I could not pick the difference between the CD and the NT-1 — I must be getting old!

I progressed to a new Audiophile Test Disc, 'The Best of Chesky Jazz and More Audiophile Tests Volume 2' (Chesky JD68), and recorded five different tracks. Then I repeated the same procedure with time delayed NT-1 input to the replay system so that I could compare a number of the more critical and appropriate tracks — including David Chesky with Chorinho No 1, McCoy Tyner/Miss Bea and Orquesta Nova playing 'Wapango'. These particular pieces provide test signals for which there *ought* to be audible differences between a 14kHz bandwidth and a 20kHz bandwidth.

Of course jazz music with frequency and dynamic range characteristics as wide as those exhibited on this disc provides a perfect means of assessing the musicality of a recording system, and yes, I could just detect the differences between the original CD and the NT-1's digital output. But let's not kid ourselves — the differences were extremely small, and by no means as pronounced as you might have thought.

The third CD I tried copying features Placido Domingo in 'Entre Dos Mundos', celebrating the 500 year centenary of Spain with 18 delightful songs appropriately backed and beautifully rendered. The human voice provides an unusually effective reference source, and Placido Domingo's voice is a veritable musical instrument in its own right.

I could detect a difference between the source and the copy, but I would not like to say that the copy was inferior to the original. However, before I confuse the issue, I think it only fair to point out that Sony is not marketing the NT-1 as a recorder for music, nor as a copying system for CD's. That type of usage is most probably the last thought to have entered their corporate mind.

Summarising

The NT-1 is without a doubt the most accomplished tape recorder (or micro-recorder), that I have yet seen or reviewed. It embodies more new and outstanding technology per gram than in any other piece of equipment I've yet reviewed. Its initial use will undoubtedly be limited, as Sony do not intend to offer it for sale through the normal retail outlets.

Don't let that worry you, however, for as I see it, the future of the NT-1 itself is not really an issue. The point is that we can reasonably soon expect to see this technology progress into a whole new generation of consumer-orientated as well as professional tape recorders, whose power and potential will undoubtedly eclipse whatever type or format of recorder has previously been regarded as the norm.

The first new consumer product to incorporate some of the more basic elements of that technology will be Sony's MD (mini disc) recorder, which is about to be

Continued on page 44

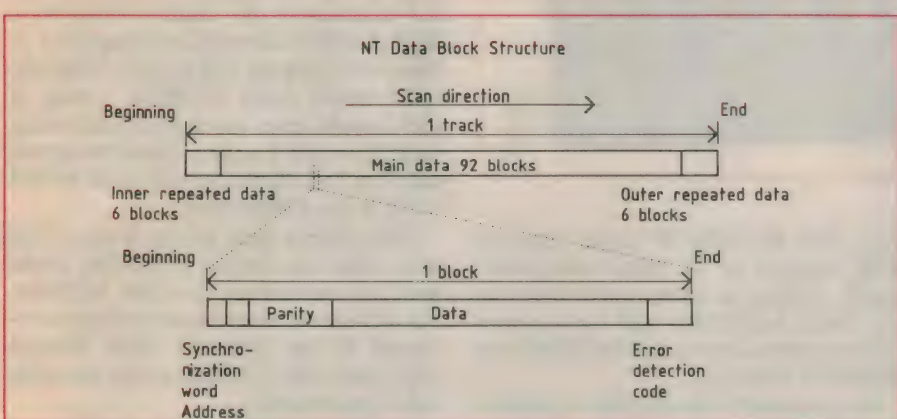


Fig.4: The secret of the system's ability to rearrange the replayed data back into the correct order is shown here. Each track of data is split into 92 small blocks, each provided with its own address, parity and error detection codes.

Modifying a cheap VHF radio to get...

A $40 WEATHER SATELLITE RECEIVER!

Have you been intrigued by those weather satellite images, but held back from trying to receive them yourself because of the cost of a suitable VHF receiver? Well, there's hope for you yet — the designer of our very popular Listening Post decoder has found a really low-cost set that works surprisingly well for Wesat reception, when combined with a suitable preamp and antenna.

by TOM MOFFAT, VK7TM

An obstacle to home weather satellite reception has long been the high cost of a 'professional' quality VHF receiver needed to collect the satellite signals from space.

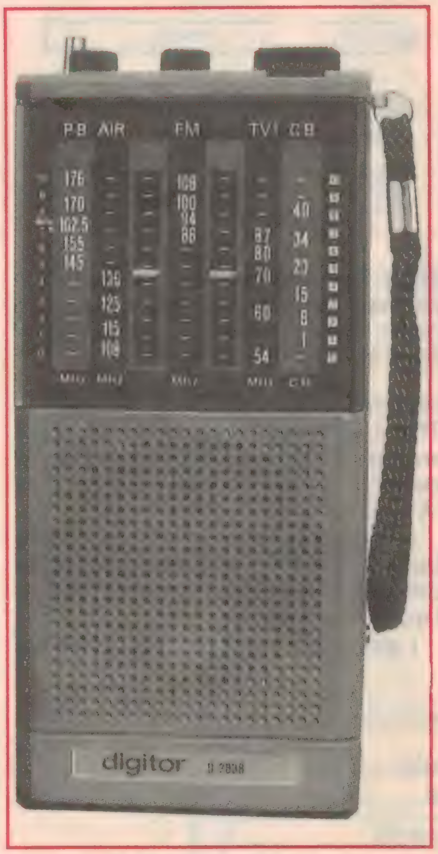
Since the Listening Post WESAT project was described in June-July-August 1992 *EA*, I have had many letters and phone calls from people saying they would love to get into weather satellite reception, if only they could find a good cheap VHF receiver.

Well, to all you people who backed away the first time, listen up! The receiver problem has been solved, and you can now receive good quality weather pictures for under $40 — less than 1/20 the cost of a 'proper' receiver. You will still need a preamplifier and a good antenna such as the Lindenblad described in August *EA*, but these are nothing compared to the cost of a 'quality' receiver.

The 'Digitor' Multi-Band VHF receiver is sold by Dick Smith Electronics, catalog number D-2838, for $39.95. This Chinese-made radio covers VHF frequencies between 54 and 176MHz, and the 27MHz CB radio band. The VHF services covered include low-band VHF FM, broadcast FM, TV sound, aviation AM, the two-metre amateur band, marine, and high-band VHF.

And right in the middle of all this is the 137MHz weather satellite band! (The 'Weather' label on the Digitor's dial is not for satellites, by the way. Instead it refers to the recorded weather forecasts broadcast in the USA on frequencies around 162.5MHz.)

On VHF the Digitor appears to use a detector that is sensitive to both AM and FM. The 10.7MHz IF stage used on VHF appears to be quite unsophisticated, striking a compromise between the 15kHz bandwidth used for two-way radio communication and the 200kHz or so for FM broadcast.



But, ironically, this lack of sophistication makes the Digitor ideally suited for weather satellite reception; on 137MHz the radio can accept modulation up to 40kHz before distortion becomes evident. This is just right for the weather satellites' deviation of 30kHz or so, plus a bit of slop for satellite doppler shift. The radio appears to have an effective AFC (automatic frequency control), so doppler shift is no problem anyway.

The Digitor's sensitivity is about what you'd expect from a radio of this class; it takes around six microvolts to produce a noise-free signal. But with the help of a preamp, specially tuned for the satellite band, this improves to a fraction of one microvolt. The radio's rejection of spurious and image responses is less than ideal, but again an external sharply-tuned preamp puts things right.

The 'VK5 VHF Preamplifier Kit' works beautifully with this radio. The kit was mentioned in the third Wesat article in August's *EA*. It's available for $23.00 posted from the Equipment Supplies Committee, PO Box 392, Marden, SA 5070. Cheques should be made out to 'WIA S.A. Division'.

I discovered the Digitor radio in a Dick Smith Electronics newspaper ad — there was a photo, and it looked like the radio would cover 137MHz. I went in and bought one, on the understanding that if I couldn't squeeze satellite signals out of it, I could return it for a full refund (DSE is good about that).

Ten minutes after taking it out of the box, I had the Digitor producing honks and tick-tocks from weather satellites, via an outdoor antenna and preamp connected to the Digitor's whip antenna with clip leads. Needless to say the radio didn't get returned.

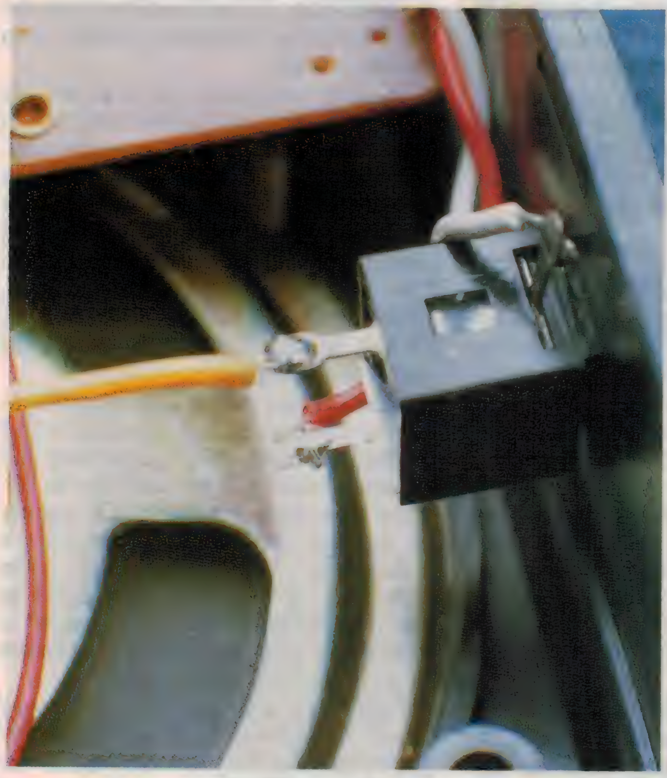
The clip-lead method works, but it gives an open invitation to stray FM and TV signals to come in and demolish the weak satellite signals. A couple of

The complete weather satellite receiving station: the antenna signal connects to VK5 preamp (silver box) via BNC connector on left. The amplified (and filtered) signal leaves the preamp via a BNC-to-RCA adaptor, RCA connector, through a length of microphone cable to a red 3.5mm plug on the left side of radio. Audio from right side of radio (black plug) connects to the Listening Post WESAT decoder (black box) via more microphone cable. The data cable (not shown) from the rear of WESAT decoder connects to the printer port on the computer.

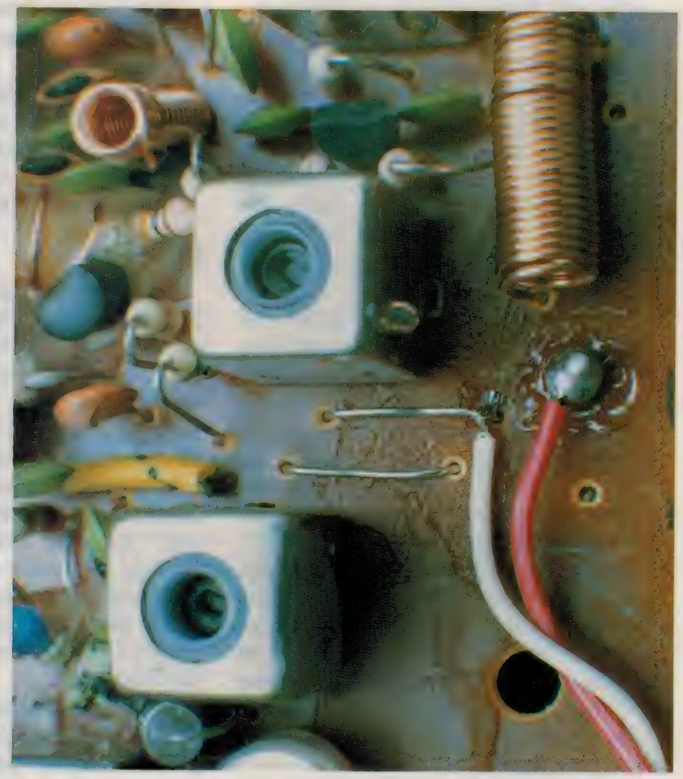
small modifications make the Digitor a much more civilized satellite receiver, while allowing it to work normally for other uses.

The first mod involves the installation of a decent external antenna input, and the other mod prevents the speaker cutting off when you take audio from the earphone socket. The radio is very roomy inside, and the modifications are simple to do. They might make a good practice run before you tackle building a Wesat kit. Just follow the simple instructions:

1. Remove the back of the radio. There are two screws through the back, one at the top near the antenna and the other within the battery compartment. The back will still be held on by some small plastic protrusions that mate with little notches in the case. You can release these and pop off the back by gentle prying with a thin-bladed screwdriver.
2. The back will still be attached to the radio by power wires from the battery compartment, and the wire (probably yellow) from the whip antenna. Unsolder the whip antenna wire from the circuit board, just below the loading coil. It's the spot marked 'R' in Fig.1. The back can now be folded right open, held only by the power wires.
3. You must now mount a 3.5mm 'shorting' type miniature phone socket for the external antenna connector. Drill a 1/4" hole in the side of the case, about half way between the bottom of the whip antenna (when the back is in place) and the battery compartment. There is plenty of room here. Start with a small drill and work up in stages. The plastic is soft; prune away any dags with an Exacto knife or scalpel. DO NOT let any plastic get into the speaker, or rock-and-roll

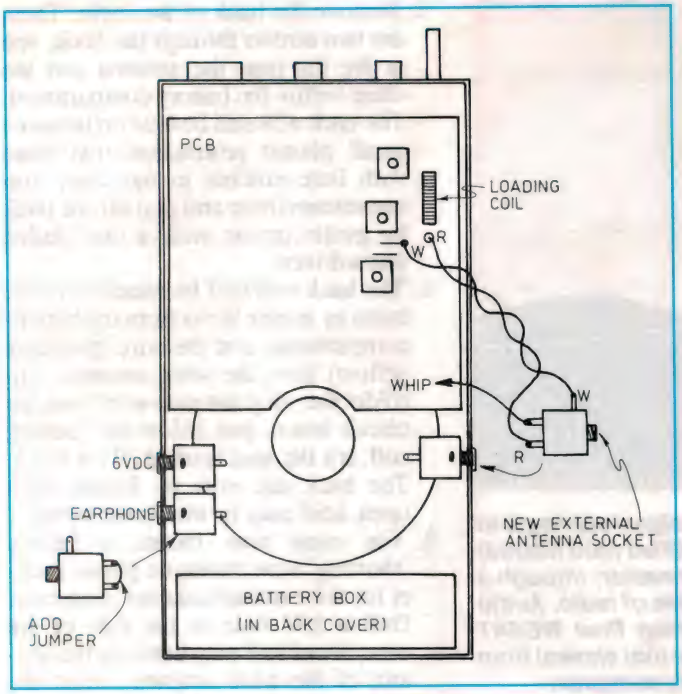


The newly installed external antenna connector. Red and white wires go to the PCB, the yellow wire goes to the bottom of the whip antenna located in the back of the case.



The antenna connection to the PCB. The red wire is antenna 'hot', the white wire is ground. Don't forget to twist the wires together.

$40 Weather Satellite Receiver



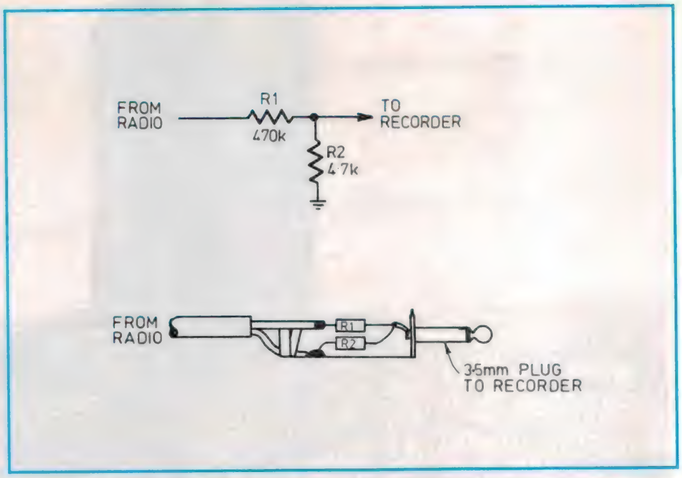


Fig.2 (above): Details of the voltage divider Tom used to feed signals from the modified Digitor radio into his recorder.

Fig.1 (left): A diagram showing the simple modifications needed to provide the Digitor radio with an external antenna socket and provision for leaving the speaker in circuit when audio is taken from the earphone socket.

music will become scratch-and-scrape. Temporarily mount the connector to check it for fit (see Fig.1).

4. With the hole thus prepared, remove the socket from the radio and get someone to hold it steady for you. Connect two lengths of different coloured hook up wire to the socket as per Fig.1. The photos show a red wire for 'hot' and a white wire for 'ground'. Twist them together (this reduces external pickup) and then cut them off to about 150 mm. You can now permanently install your new socket, with the wires pointing toward the PCB area where you removed the whip antenna wire before.
5. Just below and to the left of the pad where the whip was connected, you will see two wire jumpers. The upper of these is ground. Strip and tin the 'ground' wire from your 3.5mm socket and then solder it to this jumper. Be sure it is well connected and not shorting to anything nearby. The photo should make this clear.
6. Solder the 'hot' wire from your 3.5mm socket to the pad where the whip antenna was previously connected. This is marked 'R' for red on Fig.1. (Purists will note that because of the loading coil, this is not a 50-ohm point. Don't worry, be happy — it works fine!)
7. Solder the loose wire from the whip to the unused connection on your 3.5mm socket. This completes the external antenna connector installation. Whenever you plug in an external antenna, the whip will now be disconnected. With no plug in the socket the whip is reconnected exactly the way it was prior to the modification.
8. Finally, solder a short jumper wire between the two 'hot' connections of the existing 'Earphone' socket — see Fig.1 again. This prevents the speaker from cutting off when you insert a plug to connect the received audio to a tape recorder or Wesat decoder. You need the speaker for monitoring the signal.

Input cable

You must now make up a short cable to connect the preamp to your new external antenna connector on the receiver. Assuming the preamp is near the radio and not up near the antenna, a half-metre length of single conductor shielded microphone cable can be used.

This is much easier to work with than co-ax, and it is easy to attach a 3.5mm plug for the radio. An RCA type 'phono' connector is a good choice for the preamp output. (Don't laugh — these work great right up through UHF. Heavies like Motorola use them all the time.)

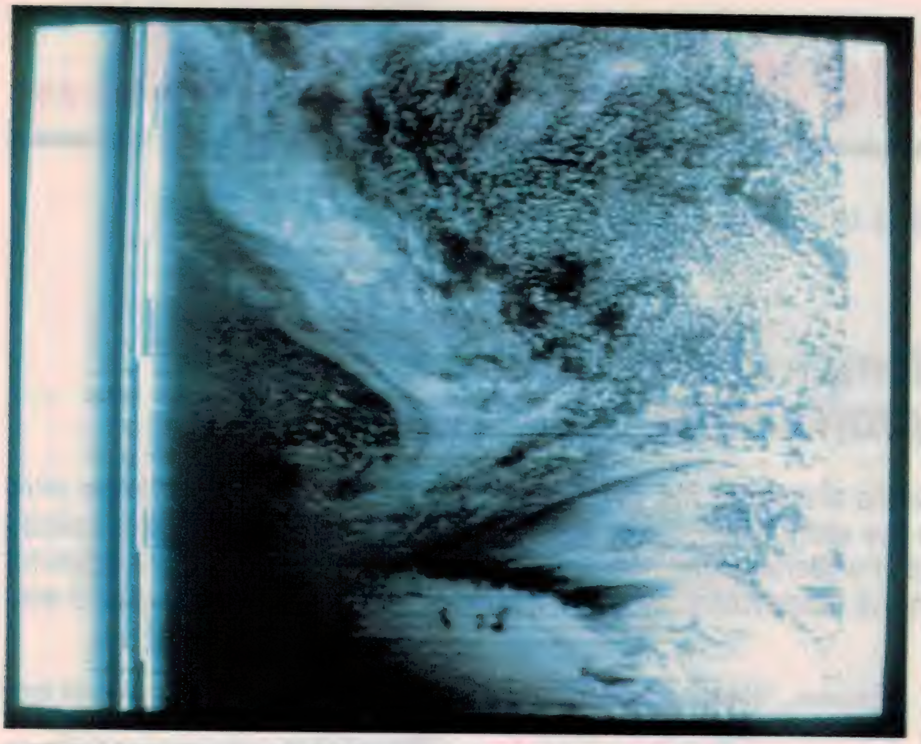
Now to the audio side of things. With the volume control on the Digitor set to a 'comfortable listening level' so the tick-tocks don't drive you mad, the voltage at the 'Earphone' connector will be about 1V peak-to-peak.

You will probably need to use a voltage divider to cut this down to a level more suitable for a tape recorder mic-level input — say 10mV. That would suggest a 100/1 voltage divider, perhaps made up of a 470k and a 4.7k resistor as in Fig.2. You can fit both resistors within the MIC plug. If feeding direct into the Wesat decoder, a different divider ratio may be needed.

The only remaining job is to provide an antenna. The Lindenblad design from August's *EA* is highly recommended. Many people have built them from the article and reported excellent results for weather satellite reception. I understand one version may even be in use as an FM broadcast transmitting antenna, scaled up from the design in the article. This is as Mr. Lindenblad (and King Kong) had intended.

The Digitor's tuning dial is rudimentary, to say the least, but it is easy to find the satellite band. With the preamp and antenna connected, just tune for an obvious noise peak around the 136 marker on the dial. This is the preamplifier's 'noise floor'. You'll hear the hiss come right up, and then drop away again as you tune through. The 'noise hump' is shaped just like the preamp's response curve in the Lindenblad article.

Within that noise area there's no way to tell exactly which satellite frequency you're tuned to. So you must wait for the time the satellite is expected to appear (as predicted by Traksat or some other program) and then tune around for it.



A 'Meteor' weather satellite picture received with a Digitor VHF receiver. The location is the Southern Ocean, due south of Western Australia. The picture shows very cold, unstable air, which a few days later dumped record snowfalls on the south island of New Zealand. A sunrise over Antarctica is at the bottom of the picture; the lower left corner is still in total darkness. The northern edge of the pack ice is very clear.

Once the signal rises above the noise it's easy to tune, and the radio's AFC soon locks onto it. Then start the tape, or decoder, and you're away.

Bear in mind that this $40 satellite receiver will never be quite as good as a $1000 satellite receiver. If it was, there would be no need for $1000 satellite receivers, would there?

The biggest difference is that expensive radios are carefully shielded to prevent signals from leaking into places where they're not wanted. So reception with a 'cheapie' under really heavy interference conditions might be difficult.

Also, the Digitor's detector isn't really 'precision' since it responds to AM as well as FM signals. The detector's output level can occasionally vary with fades of the input level, resulting in minor glitches on the picture.

But for the average user, in the average location, this $40 satellite receiver should do a remarkably good job. After all, any good receiver has a nice sensitive front end, and an IF bandwidth just wider than the signal being received. In this case the VK5 VHF Preamp serves as the sensitive front end, and the Digitor radio provides an IF of appropriate bandwidth.

Because its bandwidth is narrower than a more expensive receiver using 'WIDE FM', the Digitor's ultimate receiving range is somewhat greater. In the photo, the satellite's path is well west of the receiving station in Tasmania, with a closest approach of 2277km. The signal is still good from far into Antarctica, although there isn't a lot to see. Most of the continent in the lower left of the picture is in darkness, with the sun just rising from the northeast. In Tasmania the time was 11:00am.

Of course to produce weather pictures on your screen, you'll need a decoder such as the popular Listening Post WESAT project described in *Electronics Australia.*

The kit is available for $99.00, posted to Australia or New Zealand, from High-Tech Tasmania, 39 Pillinger Drive, Fern Tree, Tasmania 7054; phone 002 39-1391. You must include money order or cheque with the order, Australian currency only. We can include a disk with a shareware copy of the Traksat program for an extra $10.00.

High-Tech's kit factory is working pretty efficiently now, usually getting the orders out the same day they're received. So there's every chance you can be receiving weather satellite pictures before Christmas. Or soon thereafter, if Father Christmas is kind to you! ❖

When I Think Back...

by Neville Williams

Public Address Systems - 2: Laurie Simon, SA's professional PA pioneer

In complete contrast to last month's article on the evolution of small scale public address (PA) systems, we present this month the story of an old timer who is credited with having pioneered commercial PA in South Australia. It underlines the huge gulf that separates equipment needed for large-scale public functions from the 'handyman' systems installed in local community halls and churches.

As an 'old-timer' in the radio industry, L.K. (Laurie) Simon (Fig.1) first contacted me in May of last year, expressing his appreciation of the 'Think Back' series. He had read then-current instalments with special interest, he said, because as a one-time manufacturer/supplier to the South Australian market, he had experienced at first hand the various aspects I had discussed of the design of 1930's-style mains powered receivers. However, the real highlight of his technical career had been in developing commercial PA equipment. He had long been tagged in SA, he said, as 'the pioneer of public address', without apparent dissent in his home state.

He accepts that he may have been anticipated in the eastern states. An ex-employee of STC, for example, recently claimed that STC had a long history in the field, having set up PA equipment in Canberra for the opening of the original Parliament House — in 1927 — while Laurie was still an impecunious teenager!

In fact, Laurie Simon was born on what is now Main South Road, Mile End, SA, in November 1912. The eldest of seven children, he attended primary schools at Renmark and Loxton and then spent a year at Sacred Heart College, close by the the family home in Somerton.

That saw him to the legal age of 14, when he left school, officially literate but showing signs of having, in the process, been bitten by the 'wireless bug'. He found a job immediately — as assistant mechanic in his father's motor garage. That was cut short, however, by the great depression, which brought the motor trade to 'a complete standstill'.

A new career

Fig.1: A recent snap of Laurie Simon, still alert and well for his 80 years. He recalls a career combining technical achievement with community service.

As it turned out, Laurie was fortunate to find another job with Newton McLaren Ltd, a large electrical engineering and wholesaling company — one of the first to market AWA battery powered wireless sets. Laurie's job, initially, had to do with servicing lead-acid batteries, which left him with "lots of little holes" in his clothes!

Proving deft with eyes and hands, he subsequently inherited the task of rewinding bobbins for headphones and horn loudspeakers, involving extremely fine enamelled wire. For this he was paid the grand sum of 12/6 ($1.25) per week — from which he could hopefully spare 3d for a copy of *Wireless Weekly*, by way of technical nourishment.

Laurie notes that the only trade training school available in SA at the time was the School of Mines, which covered electrical engineering 'but with no wireless/radio content'. The modern term electronics, he adds, 'wasn't even part of the local lingo'!

After a year at Newton McLaren, Laurie felt convinced that he could earn more by repairing headphones and loudspeakers on his own account and by building crystal sets and other small receivers for private sale. So he set up his own workshop in the backyard garage at the family home at Somerton, and convinced his father that he should display them for sale to his remaining motorist customers.

In 1929, the Simons family registered a separate company to cover the new activity. It was Laurie's company but, since Laurie was only 17, his father had to endorse the paperwork. They arrived at the name 'Nomis' by the simple device of spelling the family name backwards. The notion to do so was picked up from a large warehouse company, Cornell; when they set up a new company to handle British motor cycles, they called it Lenroc Ltd!

Speaking of motor cycles, Nomis Radio's first vehicle was a BSA, which was later fitted with a sidecar modified to carry a battery wireless in a rear compartment. Laurie recalls that, long before they had sealed roads, he and his father would head off into remote farming areas seeking buyers. Sales were hard to come by in those days, he said, but 'we were prepared to do anything, anytime for an extra quid'!

Fifty years later (Fig.2), at a golden jubilee celebration attended by SA Premier David Tonkin, Laurie Simon recalled that he had felt like a 1929 reincarnation of Marconi as he assembled simple sets and wound coils and transformers in his very own factory.

Make, buy, sell, service

It would seem that, from the outset, Laurie Simon had decided to keep his fledgling company as broadly based as possible. He would sell parts and receivers wholesale or retail, building what he could and buying in what he couldn't. He would also provide comprehensive back-up service.

For extra measure, he says, he became 'infatuated with a new toy': the idea of adapting wireless technology to amplify speech and music at public functions indoors or outdoors — in short, the concept of public address. In the absence of accessible information or ready-built amplifiers, he had to work out the practicalities for himself. And he certainly didn't waste any time. I quote from his notes:

Maybe I had a bit of a flair for amplifying sound, because I set to and custom built units to suit particular venues and conditions. Despite the lack of proper tools and crude working conditions, I somehow managed to make my own transformers, inductors and metalwork.

In that formative period, he must certainly have been a very busy young man. A brochure covering 'The New Nomis Radio 1933 Series' depicts a 6-valve superhet for £29/10/0, a 4-valve set for £18/17/6 and a 3-valve model for £10/17/6, all in upright console cabinets. Obtainable 'on a small deposit and easy terms', all were covered by a 12-month guarantee.

The brochure further notes that Nomis could supply battery sets for country use, and special receivers for areas serviced by DC mains.

Nomis were also offering receiver service and 'rebuilds by experts at reasonable prices', plus radio replacements, accessories, valves and so on.

For extra measure, the brochure listed 'Speech Amplifiers' — 1933 speak for PA — supplied to order or available for hire. Prospective customers had the option of enquiring at the Nomis factory at Cudmore St, Somerton, or showrooms at Jetty Rd, Glenelg.

Sound amplification

It would seem from Laurie's notes that his urge to get involved in public address was no mere fad. Around 1930, he says, 'Bing Crosby fever' hit Adelaide, giving rise to big bands, and to crooners and masters of ceremony, using cardboard megaphones to assist voice projection. One scarcely needed to be a genius to predict an ultimate role for voice amplifiers.

Fig.2: As featured in a newspaper on the 50th anniversary of Nomis Electronics — SA Premier David Tonkin (left) tunes in a vintage radio produced by Laurie Simon (right) shown with his wife Eve (Yvonne). Atop the cabinet is an early American Jensen electrodynamic speaker, often favoured for quality music and PA systems.

As it happened, one of Nomis' early contracts was to provide a loudspeaking paging system for the well known South Australian Hotel — at the time (I quote) 'Adelaide's only elite establishment'. The first such system in the State, it generated unsought publicity when 'touchy' patrons created a fuss about their names being called out loud in a public place!

The system used a Nomis 'home-made' Reiss (transverse current) microphone which fell victim to an idle switchboard operator/announcer, toying with an old-style office pen. The tip penetrated the metal grille mesh and split the mica diaphragm, allowing the carbon particles to cascade out onto the desk!

The first installation in a public dance hall by Nomis was in the Rinca Hall, next door to Adelaide's St Francis Xavier's Cathedral. It also used a Nomis Reiss mic.

In 1932, Laurie set up a rather more pretentious system in Adelaide's Palais Royal, now a parking station opposite the Royal Adelaide Hospital. The occasion was an old-time ball, expected to attract around 900 patrons. On stage was Harry Boake's 12-piece band, with popular vocalist Frank Kennedy — who had been enticed from the 'Rinca'.

'Palais Royal' system

In retrospect, Laurie rates the Nomis system installed for the occasion as 'rather crude', even if it reflected current technology. The single microphone was the faithful old Reiss, feeding straight into the front end of the amplifier.

This, in turn, comprised a normal voltage amplifier feeding into a 2A3 power driver, transformer coupled to a pair of type 50 output triodes in class AB push-pull. These delivered 10-odd watts to two 8-inch (20cm) electrodynamic loudspeakers, mounted in large, home-made wooden horns. (Remember my observations about horns, in Part 1)

Proceedings got under way with the Big Band doing its normal thing. But instead of the vocalist reaching for his cardboard megaphone, he walked over and sang into the microphone. The dancers were amazed by the new sound and so many paused to listen that, for a while, it seemed more like a concert than a ball!

Not surprisingly, the amplifier became a fixture in the Palais Royal, being subsequently up-dated with an Astatic D-104 crystal mic and later with a studio quality capacitor (condenser) mic, which gave sensational results. (More about this in part 3)

Over the mid 1930's, Nomis was commissioned to fit out a whole string of SA dance venues, including the 'Embassy', the 'Palladium', 'King's Ballroom' and many others — with virtually all of them clamouring for a condenser microphone.

Condenser microphones

In essence, condenser microphones comprised a thin aluminium foil diaphragm stretched tightly and clamped across the machined face of a heavy, circular metal disc, essentially part of the 'earthed' body of the microphone. Thin insulating washers around the edge of the diaphragm isolated the foil, allowing a

DC potential of 100 or more volts to be applied to the diaphragm through a high value resistor (e.g., five megohms).

When sound waves caused the diaphragm to vibrate, the capacitance between it and the body of the unit would vary, causing a sympathetic voltage change across the resistor. By feeding this to an adjacent preamplifier stage, sufficient signal could be obtained to drive a sensitive amplifier.

Condenser microphones owed their reputation for faithful sound reproduction to the fact that the only moving part was a paper-thin diaphragm, by nature relatively free from mechanical properties likely to cause resonance effects or non-linear movement.

Laurie Simon says that he bought the first two of them second-hand from the PMG's Department, when they were pensioned off from radio station 5CL. In their original form, as still pictured in Adelaide's Telecommunicatioms Museum, they were positively ugly, with the capsule and preamplifier mounted in a rectangular wooden box (about 170 x 170 x 150mm) atop a heavy wooden floor stand.

For stage use, Laurie clamped the capsule inside a brass ring atop a less bulky metal stand, with a cable running down, either to the amplifier alongside or to a wooden box on the floor containing a preamp and batteries, with a low impedance lead to the power amplifier elsewhere.

The one problem they encountered with this arrangement was with would-be Bing Crosbys that breathed all over the microphone, either huffing and puffing it sufficiently to cause a mechanical short or creating internal moisture droplets through pinholes in the foil. In an emergency, a standby capsule could be substituted in one minute, with an ex-PMG mechanic on staff who was able to remove and renew suspect diaphragms.

(The modern 'electret' microphone is similar in principle to a condenser type, but a metallised polycarbonate diaphragm or other relevant surface is processed to store a permanent dielectric charge, thereby obviating the need for an external polarising voltage. The buffer amplifier is usually a miniature battery-powered transistor type built into the microphone case.)

Amplifier philosophy

Reflecting on that original 'Palais Royal' amplifier, with a 2A3 triode driving class AB triodes, Laurie added that, 'from day one, he had been a triode man'. Fed from a power driver through a step-down transformer, big triodes could cope magnificently with signal peaks and the vagaries of loudspeaker loads.

Fig.3: A typical De Havilland Fox Moth biplane, as used for aerial PA by Nomis, and subsequently in WA by the Flying Doctor Service. Note the open cockpit and the tiny cabin between the wings, immediately behind the motor. (By courtesy of Ansett, WA).

Over the years, to cope with competitors, he had manufactured hundreds of amplifiers with 807's, 6V6's, KT66's, KT88's and the like. On the bench, with resistive loads, power tetrodes and pentodes were fine, he said, but if abused in the field, they 'fell over' with distortion.

Laurie Simons' pride and joy in the old days was a big integrated job — all on one chassis — offering 300-odd watts of output from a pair of transmitter-style 805 triodes, each 8.5" (21.6cm) tall. Nomis built quite a few such amplifiers over the years — some for hire at large public functions, others to provide speech, communication and music in large factory complexes.

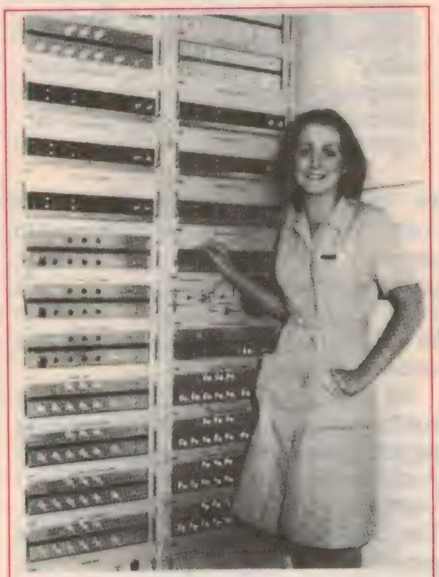


Fig.4: A Nomis communications system produced for the Adelaide Childrens hospital. It provided bedside music, radio, TV sound, paging and intercommunication for the hospital proper and associated nursing homes.

Two 6J7-G's up front provided access for two microphones, typically dynamics fed in via balanced lines and Trimax input transformers. Next came a 6A6 twin triode, providing channel mixing and additional gain to drive a triode-connected 6F6-G through a simple network offering optional bass cut.

This was transformer coupled to push-pull 2A3's, which turn drove the 805's through a double push-pull class-B transformer. As per ratings, the 805's operated with zero grid bias, with a current meter in the heater centre-tap earth return as a check on idle and dynamic current levels.

The chassis carried two separate power transformers, one to provide the filament voltages and HT supply for the lower powered stages, the other the 1200-odd volt HT supply for the 805's — per medium of a pair of 866 mercury vapour rectifiers. Filtering for the latter involved a 'swinging' choke, its impedance varying in inverse proportion to current drain, followed by four 16uF series-connected electrolytics.

Outdoor PA

Dwarfing the installations necessary for dance venues, multiple amplifiers of the above proportions were needed for a whole series of outdoor occasions serviced by Nomis in Adelaide and elsewhere.

The first of these, according to Laurie Simon, was at the Adelaide Oval in September 1935 for the presentations which marked the climax of SA's national football season. Thanks to a boldly labelled Nomis Reiss microphone visible in the press photo, the crowd not only got to

enjoy the second semi-final match, but also to share in the presentation of the Margarey medal for the most brilliant and fairest player in the league — a notable first!

In the meantime, Nomis had achieved another quite different 'first': loudspeaking advertisements from a low-flying plane. The idea had emerged as early as 1934, but it took a long time to work out how to go about it; to locate a suitable plane; and, last but by no means least, to gain the necessary permission from the Civil Aviation Department.

Nomis was better placed than most to come up with amplifier equipment and the means to power it aloft for an hour or so at a time. It involved a mains type amplifier, a DC/AC rotary converter, lead-acid batteries and a separate 200V/100mA DC supply for the loudspeaker field.

The most suitable plane appeared to be a Fox Moth owned by McRobertson Miller Airways, then based at Parafield. It had an open pilot's cockpit and a very small passenger cabin (Fig.5), just able to accommodate four (small) people. With the equipment in place, there was room to accommodate (awkwardly) one lone operator. The plane could be chartered by the hour, which was sufficient (in those days) to overfly Adelaide city and suburbs.

Laurie said that they also worked out a way to mount an American Jensen M-20 electrodynamic loudspeaker in a protective baffle, bolted between the wheels and facing downward. The equipment had to be installed and removed before and after each charter. The idea was to climb to the minimum practical height, then throttle back and 'coast' for long enough for the announcer (Laurie Simon) to say his piece. Fortunately, firms like John Martin, Foy and Gibson and Myers were co-operative enough to pay an appropriate fee to have their messages proclaimed from 'on high'.

For Laurie Simon, it was an interesting challenge but one that left him in two minds, on occasions, whether to reach for the microphone or a paper bag! On some flights, he said, he ended up 'as sick as a dog'!

Variety of venues

1936 proved a particularly busy year for Nomis PA, with SA's Centenary celebrations at the Glenelg Oval — including a re-enactment of the first landing, which necessitated the use of several Nomis Reiss mics, each assembled on/in a block of wood measuring 4 x 4 x 6 inches (100 x 100 x 150mm).

In the apparent absence of competitors, Nomis was commissioned to cover a succession of other public functions, including 'practically all' the race/trotting/ coursing meets, along with country shows.

At the time, according to Laurie, the regulation of the AC supply from the Adelaide Electric Supply Co was notorious. Nominally 210V, it sometimes fell to a low of 170V, necessitating switchable tappings on the power transformer primaries. Not infrequently, in those days, mains power was simply not available at some sites, making it necessary to rely on a back-breaking combination of rotary converters and heavy duty lead-acid batteries.

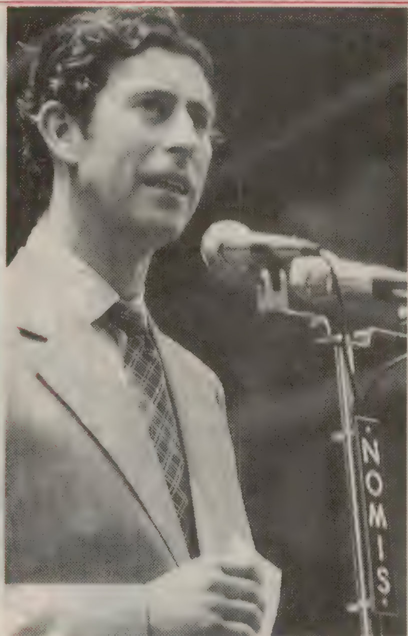


Fig.5: Nomis always attached their logo to mic stands. On this occasion, featuring Prince Charles, it provided magnificent free publicity on TV, newsreels and the press.

On Anzac day, 1936, Nomis engineers had to cope with a new problem of a quite different kind — to work out and provide sound coverage for the annual parade. The length of the route and the number of spectators anticipated demanded 'a massive amount of equipment' plus street wiring for the audio feed, complicated by trams plying the route right up to the start of the march.

1936 also saw a visit to Australia of the famous American tenor Richard Crooks. His Adelaide concerts were held at the West's Olympia in Hindley St, using Nomis amplifying equipment, which was subsequently commended by the *Advertiser* reviewer.

Richard Crooks also personally thanked Laurie Nomis for the amplification arrangements, and observed to him: "We have nothing in the States like that". Crooks insisted, moreover, that the promoters arrange to have the same system installed in the old Exhibition Building in Melbourne, for his farewell concert on September 19 of that year.

Organ buffs may be interested to learn that, to a presentation featuring Richard Crooks and combined (Victorian) choirs, the program leaflet listed a 30-minute recital of popular classical excerpts by L.E. Warner on a 'Hammond Electric Organ'.

Back to the race tracks, 1937 saw the installation of permanent PA facilities, plus the introduction of 'racecasters' at Morphetville, Victoria Park and Cheltenham — followed by Gawler, Oakbank and Balaklava.

Postwar PA

If life at Nomis was busy and varied prior to the war, it certainly remained so during the postwar years — from premises re-styled in 1949.

A permanent sound system was installed in the Adelaide Town Hall around 1948, to cater for all comers — including the ABC. Not surprisingly, it came under on-going scrutiny and was constantly being up-graded to take advantage of the latest technology.

In this same period, Nomis installed literally hundreds of sound systems in churches, schools, hotels, hospitals, stores, and shopping centres (Fig.4). At the other end of the scale, loud speaking paging systems were installed in major industrial plants, where speech had to compete with extremely high levels of ambient noise. Here again, the faithful old 805's came into their own.

In terms of scale, however, such assignments paled before the Royal tours and visits which occurred in Adelaide in the postwar period (Fig.5). *The Journal of Industry* for April 1954 gives a rundown on what was involved for the Queen's visit during the previous month.

Nomis amplification equipment had to cover a schoolchildrens' display and music festival at Wayville Oval, plus an ex- servicemens' assembly at the University Oval, plus a State Banquet and fireworks display at Victoria Park, a church service at St Peter's Cathedral, an open-air official function outside the Town Hall and a half-million spectators along the 4.5-mile (7km) route of the Royal procession.

The installation involved miles of street wiring, hundreds of loudspeakers,

Continued on page 45

The early history of Australia's Radar - 2

Following on from the first of these articles, we look now at the next chapter in the development of Australian radar systems during World War 2: the birth of the 'AW' or air warning radar. This was soon developed into the LW/AW or 'light weight' air warning radar — which still weighed over eight tonnes, not counting personnel or support equipment.

by COLIN MACKINNON, VK2DYM

Events overtook the CSIR's Radiophysics Laboratory, when on the 7th of December 1941, Japan bombed Pearl Harbour. It was suddenly realised that, like Pearl Harbour, Australia was very vulnerable to major air attack after all.

At that time only one Australian ShD station was operational, at the Army fortress installation at North Head, and others were only part-constructed or still in the contract negotiation stage. The lack of prior radar research was now painfully evident, as after a full two years of catch-up effort by the RPL, and considerable cost, all they had to show for their work was one solitary working radar station.

To compound RPL's problems, Australia had agreed to help Singapore and Hong Kong to set up radar defence systems, and when Japan invaded the South East in late 1941 — early 1942, many RAAF and civilian radar experts from RPL were among the thousands of Australians captured. Bruce Alexander, a senior RPL scientist who had been in Hong Kong and Singapore to advise on the radar installations, just managed to get out of Singapore on the second last Catalina flying boat. The last was shot down.

The events at Pearl Harbour proved that there was obviously a desperate need for a radar to alert the RAAF to incoming enemy aircraft, so RPL rushed into the development of an Air Warning radar set. Available parts from the ShD program were modified and wired up within a week.

This 'breadboard' style set was installed at Dover Heights and was in full operation by December 12, 1941. It performed satisfactorily and in fact, operated by Army personnel, it was Sydney's only air warning radar for about the next nine months.

The design proved immediately effective, so three more were built by the RPL within a month, again using available ShD and GL components. The second of these sets was flown to Darwin, but had not been commissioned when on the 19th of February 1942, Darwin suffered the first of a number of Japanese air raids.

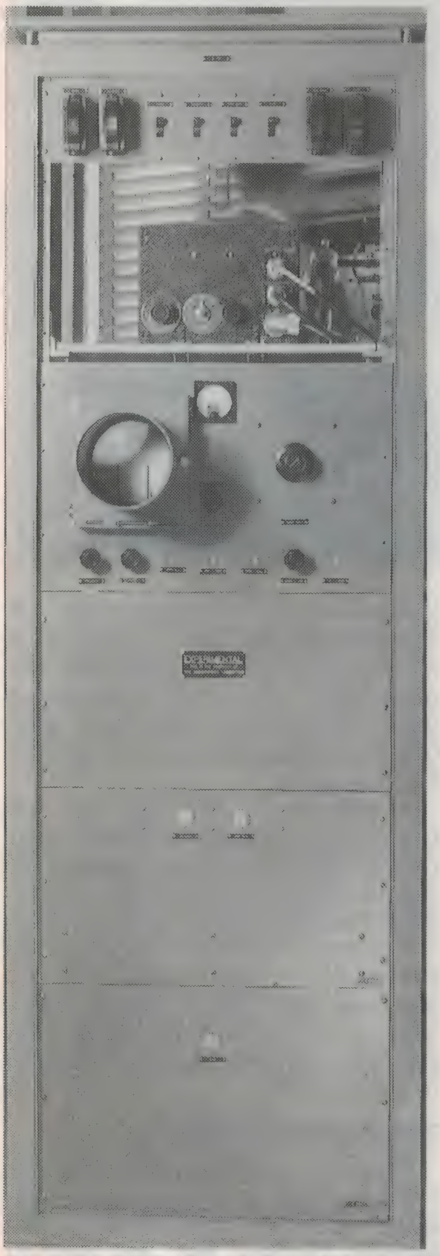
Much has been written about the Darwin debacle, and the balance of blame

Fig.11: An AW Transportable frame with corrugated iron cladding. The antenna is an English CHL and the much larger CHL transmitter and receiver are in the adjacent hut.

for not having an operational radar at Darwin seems to fall on the RAAF radar crew. However, in light of recent research it appears that the RAAF may have been unfairly treated. Further mention of this incident will be made after describing the air warning radar design.

This first RAAF early warning set was known as the AW MkI radar, with the 'AW' standing for Air Warning. It was required to give long range warning of aircraft at all heights, with reasonably accurate range and height data but needing only moderate bearing accuracy. Whereas the ShD radar had an acceptable range of about 35km against target ships with a speed of say 20 knots, the AW needed a range of over 150km against bombers approaching at 300kph — in order to give air force interceptors 30 minutes in which to take off and gain height.

To obtain this range given the limited power capacity of the available valves, the RPL had to narrow the bandwidth of the receiver to improve its signal to noise ratio. Then the pulse length of the transmitter was increased in the same ratio, to increase the return energy to the receiver. To keep the transmitter valve dissipation within acceptable limits the PRF (that is, the number of pulses per second) was reduced.



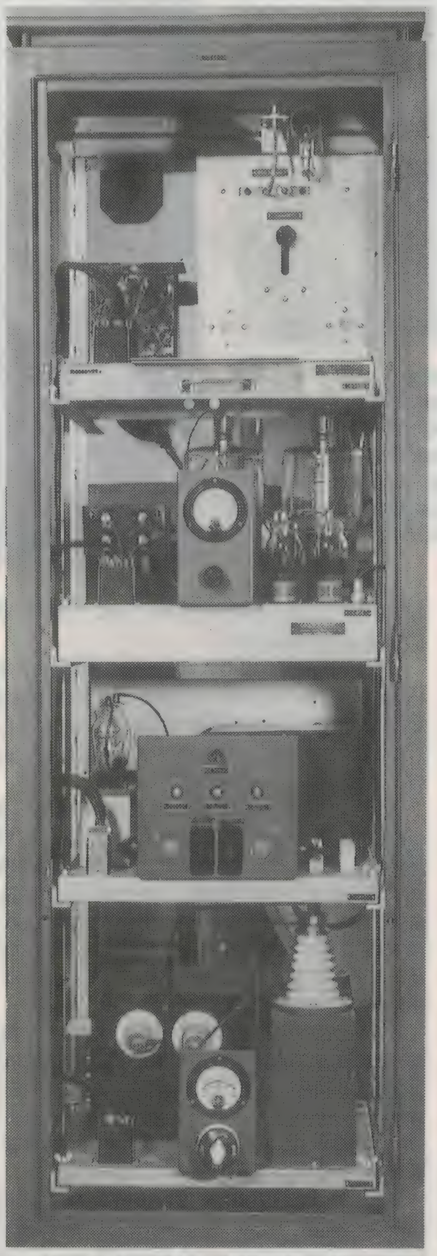


Fig.8 (left): A rare photo of the first AW receiver showing at the top the ASV receiver bolted to a sheet of plywood. Just to the right can be seen the added 807 video amplifier.

Fig.8A (right): A view of the inside of the AW transmitter cubicle. At the top is the transmitter itself, below is the modulator with two 833 valves dwarfing two 807's, then the minor power rectifiers on the next shelf, with the main HT voltage supply on the lowest shelf.

The AW MkI transmitter, designated the J23, used two VT90 triodes and achieved the same 10kW output as the ShD set. However instead of grid modulation via an 807 valve as in the ShD transmitter, the VT90's were cathode modulated by two 833 valves.

This revised design was taken from a GL MkI prototype transmitter which had shown some promise and was now pressed into service in the AW. The 833 is a large valve, able to withstand much higher voltages than the 807 and has a higher power output so was more suitable for the longer pulse length needed for the AW.

In other respects the transmitter looked similar to the ShD, with Lecher lines and a tuning capacitor consisting of two large disks. The pulse length was increased to 20us and the PRF reduced to 50 pulses per second, synchronised to the mains supply of 240V, 50Hz. The plate supply was 10kV, but could be switched to 12kV for longer range but shorter valve life. Operators tell me they needed plenty of spare VT90's, because they 'went off like popcorn'.

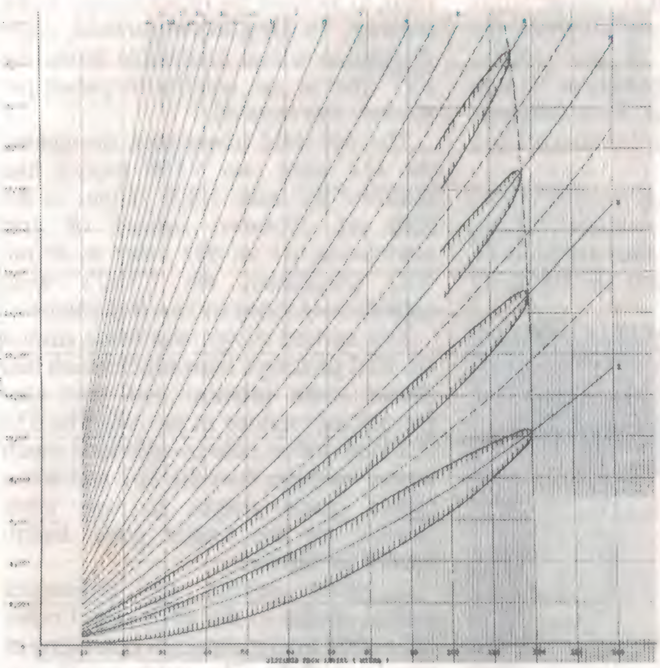
The first three AW sets had pre-production ASV MkII receivers made by the Gramophone Company of Sydney. Such was the urgency that they were just bolted to a sheet of plywood attached to the PMG racks. The receiver was retuned to 200MHz from the standard ASV frequency of 176MHz, and the bandwidth of the 30MHz IF stages was decreased to +/-140kHz.

Compared to the original ShD radar, this ASV receiver had only four IF stages and did not have a 6AC7 cathode follower. Therefore an 807 video amplifier and a 6H6 DC leveller were added externally to the receiver to feed the display tube — fitted by simply screwing tube sockets to the plywood. In other respects the valve lineup was the same as the standard ASV MkII receiver.

In subsequent production the AW receiver was mounted behind a proper front panel and the extra video driver and DC leveller valves were integrated on a new receiver chassis.

See Fig.8 for a rare photo of the first AW. Only two of the PMG 19" rack cubicles were required, because there was only one display CRT, a simplified calibrator system and no beam swinging. One cubicle contained the power

History of Australia's Radar - 2



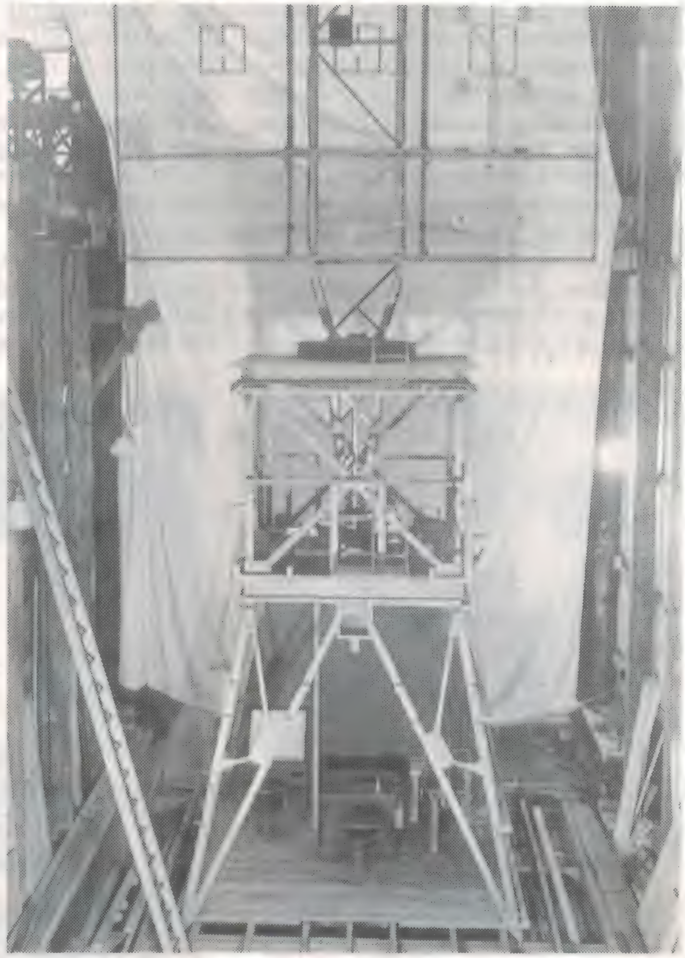


Fig.9 (above): The antenna beam pattern for the AW, showing the multiple lobes at different angles.
Fig.10 (right): The first AW Transportable, photographed in the Railways Annexe at Wilson Street, Redfern. The array is mounted on the frame for the rotation gear and chain drive, and under that is the operators' position and the transmitter/receiver units. The ShD antenna is only partially complete.

supplies and transmitter, whilst the other held the receiver and CRT and a system calibrator.

The 125mm cathode ray tube provided the range display and measurement was obtained in the same way as on the ShD, with an accurate scale attached to the potentiometer dial. Bearings were obtained by maximising the echo height, then reading the azimuth dials driven by the mast servos. Range accuracy was about +/-500 metres, whilst bearings could be read to +/-5°.

Experienced operators could even judge the size and number of aircraft from the trace on the screen. The height of an aircraft was estimated by noting the ranges at which the echo rose and fell as the aircraft flew through the multiple vertical lobes of the antenna and then referring to a graph of the beam pattern. (See Fig.9, showing the antenna lobe pattern.)

The antenna fitted to the AW MkI was the ShD array of 36 elements. Like the early ShD sets, the array on the first few AW sets was fed via 70Ω co-axial cable, but later production had 300Ω open wire feeders.

The 'beam-swinging' switch and cables of the ShD were eliminated, and all three antenna sections just matched into a junction box.

The NSW Government Railways designed a shorter square-section mast using angle iron, and adapted the ShD rotation system to be chain driven by an electric motor and gearbox.

This frame was mounted on top of a concrete hut built by the Department of Works, and was intended as a permanent installation. Although several stations, such as No.31 at Darwin, were constructed in this manner it soon became obvious that a lighter, more transportable set was needed.

The NSWGR workshop, under the guidance of their clever Chief Electrical Engineer Mr John Worledge, designed a pyramid-like frame from thick 75mm (3") angle iron to house the equipment, with the antenna fitted on top.

Galvanised iron or masonite sheeting covered the frame. No concrete foundations or buildings were needed with this concept, and it could be disassembled and moved from site to site.

The revised design was called 'AW Transportable', but those who had the considerable task of moving the tonnes of bulky equipment had a jaundiced view of what comprised a 'transportable' station. See Fig.10, showing the first AW Transportable and Fig.11, showing an AW Transportable in the field, with corrugated iron siding, and fitted with an English CHL antenna. The much larger CHL transmitter/receiver is housed in the adjacent hut.

A total of 21 AW MkI sets was made by the Gramophone Company and the NSWGR, with parts supplied by various subcontractors. These sets performed sterling service throughout the war, manned by RAAF operators and technicians. In most cases telephone land lines were run to nearby fighter bases, but often a radio backup was provided using the ubiquitous AT5/AR8 radio equipment.

The Darwin failure

Returning now to the Darwin debacle, a secret Royal Commission under Mr Justice Lowe sat shortly after the first Japanese bombing raid, and amongst other things considered why there was no radar warning system in operation at Darwin.

Evidence was taken from senior RAAF and RPL members, but it appears that not all the circumstances were revealed. Over the years others have

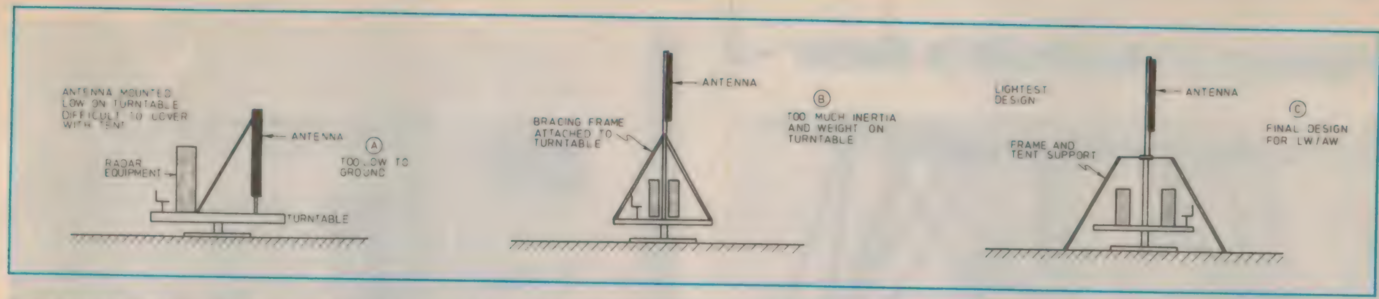


Fig.12: The three designs that were considered for the Light Weight AW set. 'C' was the one chosen.

re-interpreted the situation and several seem keen to shift the blame to the RAAF.

Recent research and eyewitness accounts give a somewhat different version, and the stories in the book *Radar Yarns* provide a better appreciation of what really happened.

The AW set for Darwin was handed over to the RAAF on February 5 for shipment by C47, the transport version of the DC3 aircraft. It will now be apparent from the above description of the AW that the antenna array, which was an ShD antenna of 5.5 x 4m of welded-up angle iron, could not fit through the doors of a C47 — which open to 2.2m wide by 1.5m high. The antenna therefore had to be cut into smaller segments, and one of the RAAF Radar Officers delegated to ship the gear still remembers the blisters he suffered whilst wielding a hacksaw to cut the array into manageable sections.

A point which is also overlooked in several reports of the events is that one C47 can carry only about 2500kg, whilst the complete AW radar weighed at least 6000kg. Therefore two or three round trips, each of four days duration, were needed to ship the complete station to Darwin.

The eight RAAF personnel who went to Darwin expecting to connect up the set obtained no help from the civil works authority responsible for the installation, and had to manhandle the tower and antenna into position themselves, on top of the concrete building.

Even before the antenna could be erected, it had to be re-assembled and welded together again.

One participant says that they had the antenna re-assembled, but lying on the ground, when the first Japanese planes flew over on 19th February.

The civil works employees all decamped for points south of Darwin at this stage, and so the RAAF men tried to lift the array themselves using a makeshift block and tackle — plus a gin pole 'liberated' from the works depot. (Remember that the array weighed around 500 to 600kg.)

After dropping the antenna once, they managed to assemble the radar during the following week — but could not get it working properly. After studying the 13-page instruction manual that RPL had written for the set on the 4th of February, I am not the least surprised that there were difficulties!

The manual sets out a mathematical procedure for cutting and matching the numerous co-axial feed lines, which almost requires a PhD to understand...

Scientists from RPL were flown up and with co-operation between all parties the set became operational by late March 1942.

Several reports have claimed that the set had been fully assembled before the first raid, but the RAAF crew was incapable of setting it in operation. This new account tends to show the RAAF

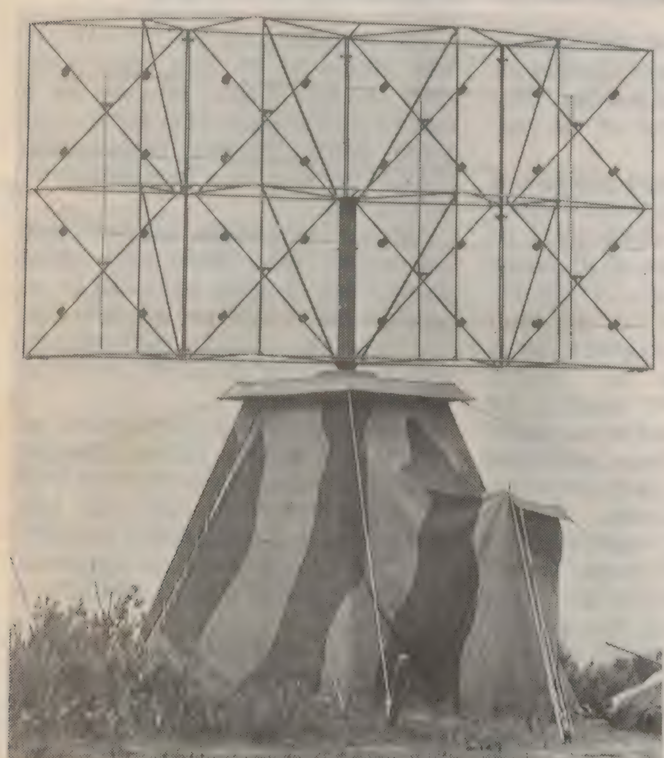


Fig.13: The complete LW/AW MkI radar.

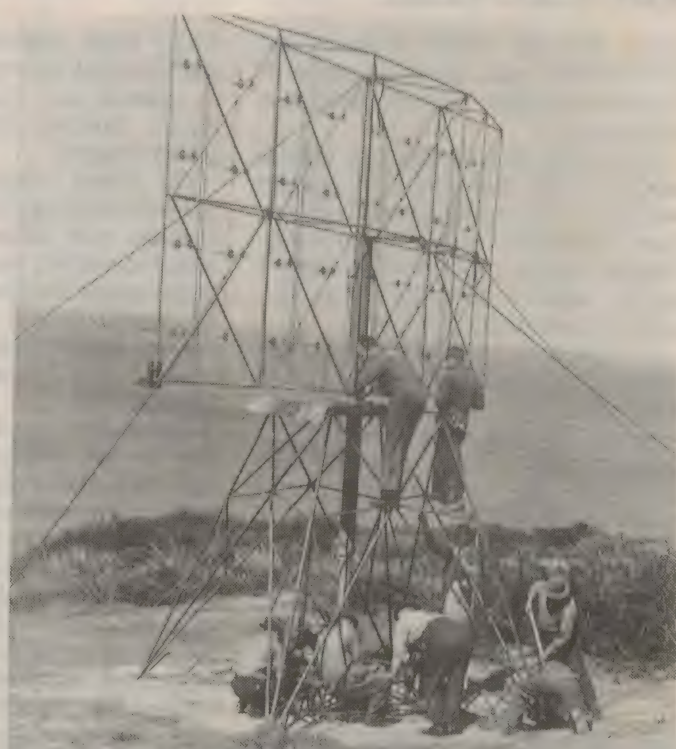


Fig.13A: Railway staff assembling an LW/AW MkI frame.

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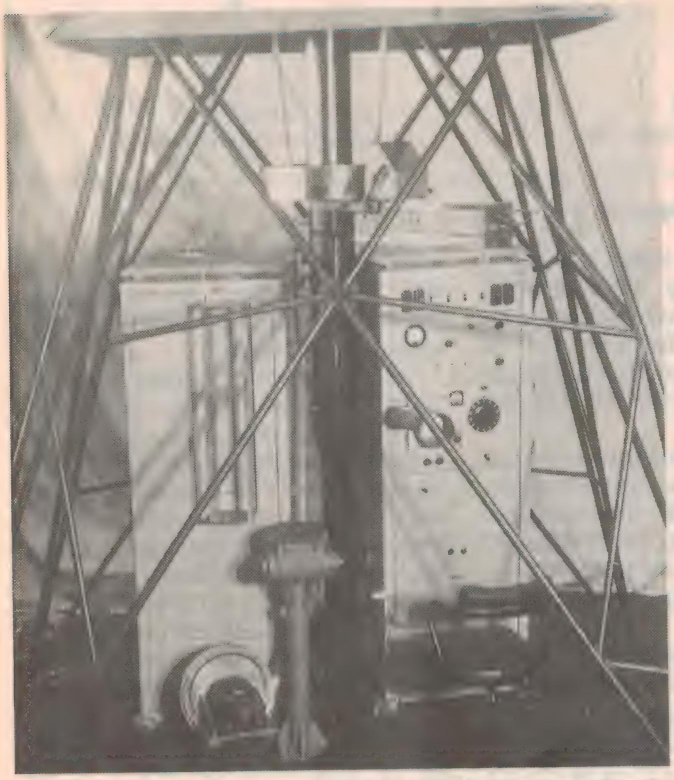

Fig.14: An internal view of the LW/AW MkI frame and radar, with receiver and display on the right. There is a cooling fan at the bottom of the transmitter cubicle and frames attached to both cubicles are antenna tuning stubs. Also visible are the turning wheel and the large drum on the mast with azimuth graduations, with a prism to reflect the readings down to operator eye level.

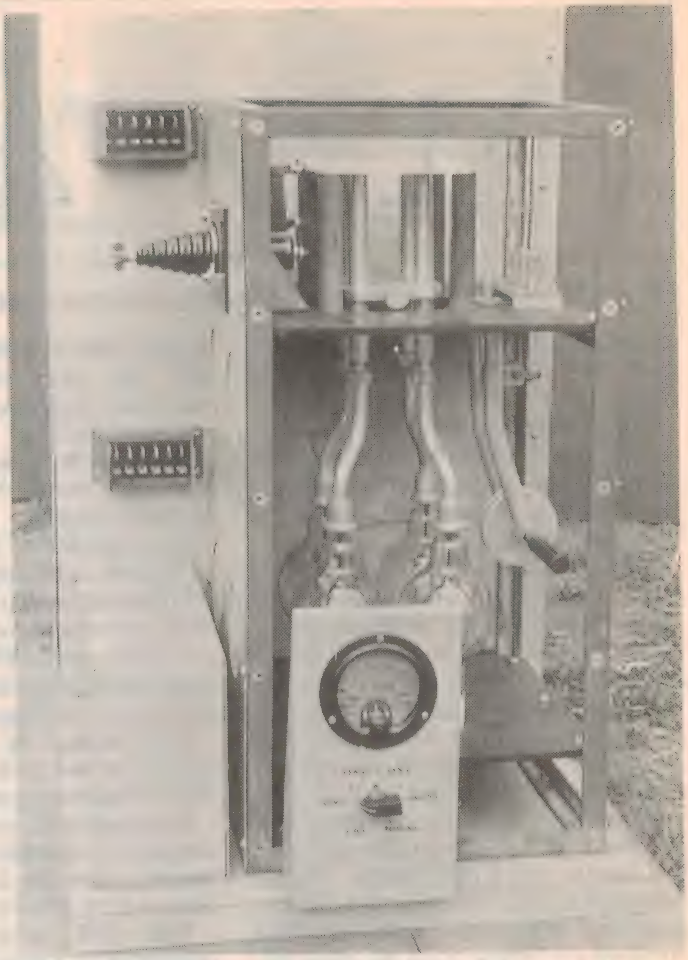

Fig.15: The MkII transmitter with four 100TH valves in a ring oscillator circuit. The plate circuit is the four vertical tubes, with the disk type tuning capacitor on the right.

people were the victims of timing and circumstances, and claims by others of incompetence seem a bit misplaced and self-serving.

Notwithstanding all this, the official enquiry found that about 30 minutes warning of the impending raid *had been given*, via radio by an island church mission and also by coast watch stations — but the military authorities were disbelieving and totally unprepared.

It required the tragedy of the Darwin bombing to galvanise the services into some action. The events at Darwin bear a striking similarity to the Pearl Harbour situation, where early warnings were also given but were ignored by the responsible officers.

The LW/AW Series

As the war progressed, the RAAF found a need for a radar station that was still easier to move from site to site than the AW Transportable — particularly when the Japanese were being pushed back through New Guinea and the Pacific islands. Wing Commander George Pither, Officer in Charge of RAAF radar, approached the NSWGR and discussed three possible designs for an antenna and operational hut. (See Fig.12, showing sketches of the suggested designs.)

The chosen design used triangulated and welded frames from 30mm (1-1/4") diameter steel tubes, which could be broken down into sections small enough to fit through the door of a C47 aircraft. By careful design, each of the component parts of this set weighed less than 100kg. This became the revered LW/AW, with the 'LW' standing for 'Light Weight' and it was so successful that the US Pacific forces purchased more than 100 of them in preference to their own cumbersome radars.

In recognition of his contributions to the innovative LW/AW design, the antenna was named the Worledge Array, after Mr John Worledge. Ern Bullock, the young engineer working for Worledge, designed in detail and constructed the first LW/AW MkI tower by sub-contract in just 30 days — a remarkable achievement. Fig.13 shows the LW/AW MkI tower and radar set.

The antenna array for the LW/AW was altered to be four bays wide, each of eight dipole elements for a total of 32. The gain of the antenna was about 16dBD. This array could be dismantled into four 2m x 2m segments for air transport.

The new lightweight antenna frame was welded from round steel tubing about 30mm diameter, and could be assembled like a Meccano set with nuts and bolts. Later versions used interconnecting yokes and clevis pins to further speed the assembly.

The antenna support mast was two interlocking lengths of 150mm diameter steel pipe, commandeered from the Shell Oil Company. The mast was held upright within a tubular steel pyramid-like frame, inside which the equipment and operators were located, covered by a canvas tent.

To allow continuous 360° rotation without complicated slip rings for the RF cables, the equipment was all mounted on a wooden turntable within the frame. As the operator cranked a large drive wheel, he and his equipment

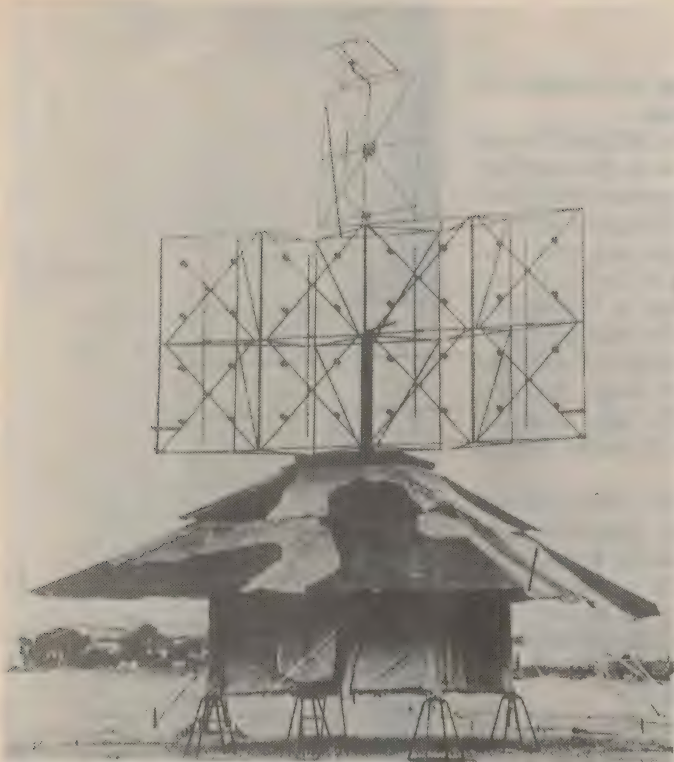

Fig.16 : The larger MkII frame and tower. Note how it was raised to improve antenna pattern, as well as aiding cooling, and hopefully keeping some nasty wildlife out of the hut. The IFF antenna is mounted on top of the main array.

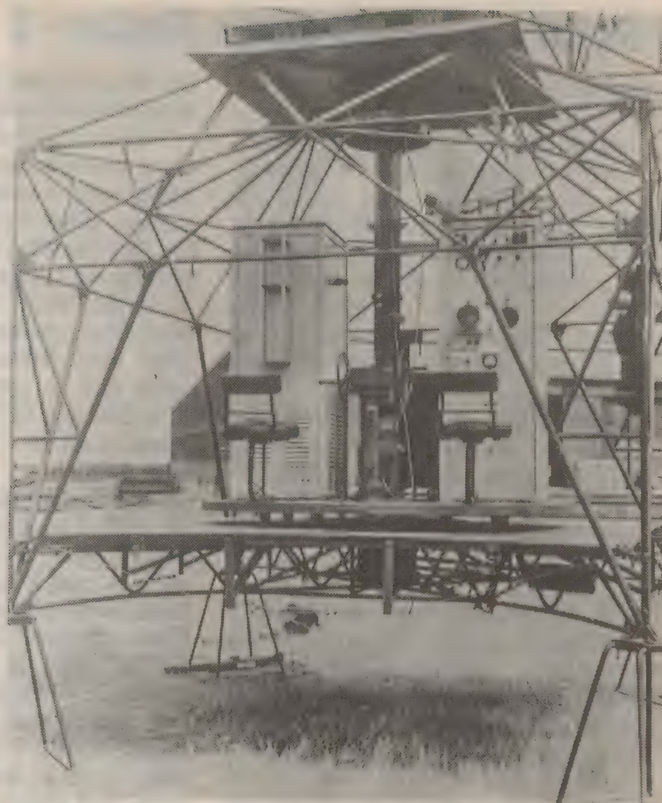

Fig.16A: The interior of the MkII frame, showing the extra room of this design.

and the antenna array all turned together, in relation to the frame and the site. The 240 volt power and telephone cables were connected via slip rings under the turntable.

A large cylindrical scale graduated in 5° increments was attached to the top of the rotating antenna column and could be seen by the operator, although he had to crane his neck upwards. In later models a prism and mirror was fitted to make the scale readable at normal eye level. The operator's seat was a train guard's seat and the drive wheel looks suspiciously like the brake wheel from a Sydney electric train. (See Fig.14, showing inside the LW/AW MkI tower.)

In search mode, the antenna array would be rotated by hand back and forth through 360° or less, whilst an operator watched the range scope. When an echo became visible, the operator would rotate the array to maximise the echo and then determine the range using the calibrated potentiometer, whilst a second operator would read off the range and azimuth.

It was possible to gain a rough indication of aircraft height by observing when the echo disappeared and reappeared, as the aircraft passed through the many vertical beam lobes of the antenna, and then referring to a lobe chart like that in Fig.9.

While some operators became adept at estimating height, in general the figures were not very accurate. The data was conveyed either by phone or radio to the local RAAF fighter base for action. Many radar stations in remote locations had resident radio operators with the familiar AT5/AR8 transmitter/receiver combination.

The calibration of each AW station usually entailed a flight around the station by a special calibration aircraft, usually an Anson or Tiger Moth, at predetermined distances and altitudes.

Power at remote locations was supplied for the first AW sets by a two-cylinder Howard motor (from the Howard Rotary Hoe), coupled to a 240 volt generator. However the Howard was not suitable for arduous 24-hour operation, and later a Ford 10 engine/generator combination was specified.

The Ford 10 motor/generator set was used with many LW/AW sets, despite its weight and bulk. But due to shortages of equipment, any available engine/generator sets were pressed into service — resulting in some weird and wonderful combinations.

An important requirement of any military activity is the identification of 'friendly' versus 'hostile' aircraft, ships etc. To accomplish this, the UK had developed the 'IFF' system, which means Identification: Friend or Foe. In the IFF system a transmitter, or Interrogator, sends out a coded radio signal and a receiver or IFF Responsor in a friendly aircraft, ship etc. would receive it and send back a coded acknowledgement. In theory, an enemy would not reply or would give the wrong code.

The allies settled on a frequency band centred on 176MHz, so that the standard ASV radar could be used. A small add-on box triggered the ASV transmitter when the ASV receiver heard the IFF signal from an Interrogator.

However as the ground radars operated on 200MHz, a separate 176MHz Interrogator/ Responsor was installed at each station.

The most common Interrogator/ Responsor was the Hazeltine BL4 obtained from the USA, and this can be seen in some of the photos, next to the radar transmitter/receiver.

The IFF antenna on Australian radars can also be seen in some of the photos, and consisted of two coaxial dipoles mounted above the main array, with mesh reflectors to reduce interference and improve directivity.

Occasionally two three-element Yagi antennas were fitted at the ends of the main array. The BL4 was connected to the radar scope so that the response showed as a downwards blip on the

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trace, at the same range as the main upwards echo.

Just as the ShD could detect aircraft, the AW could see ships, and in the early days there were occasions where the RAAF radar operators would contact the nearest Navy base to advise that they had a suspicious sea contact at perhaps 100km — only to be treated with derision, because everyone knew you couldn't see that far! Such was the secret of radar.

Despite the assurances of local electronics manufacturers regarding their experiences with tropical exposure of electronic equipment, the services found that electronic equipment suffered badly in the hot, wet tropics. Fungus grew all over the innards within hours, and corrosion ate wiring in a day or so.

Following service experience in the tropics with the first LW/AW's, which became designated the LW/AW MkI, the RAAF, RPL and CSIR between them developed a suitable tropic proofing treatment for the electronics, and cabinet heaters were incorporated in the bottom of the equipment cubicles on later production which became the LW/AW MkIA model. The heaters kept the units dry and warm during off-air maintenance periods.

RAAF research engineers came up with electronic and mechanical modifications to improve reliability and

Fig.17A: The two NT99 valves in the transmitter compartment of the LW/AW MkIII transmitter.

performance, and these were introduced in subsequent production.

Well over 200 of the MkI and IA sets were produced, and were the mainstay of our early warning system throughout the war. What is still virtually a secret is the fact that 60 LW/AW sets were supplied to the US forces in the Pacific and 12 to the British Forces in Burma, and were much preferred to their own sets. They were lighter, more reliable and often had a greater range than the SCR-270 and SCR-271 long range Air Warning sets that the US forces brought with them.

An LW/AW MkI was even fitted on the back of a US Motor Torpedo Boat, to provide air coverage during assault landings. A couple of US technical radar books show photos of US landing craft fitted with Australian LW/AW radar sets — but there is no mention of who designed and made them.

In August 1942, there was a perceived shortage of the VT90 valves which were being used in both the ShD and AW series and also in the ASV radars, so RPL designed a new transmitter using four Eimac 100TH valves in a ring oscillator circuit.

This particular valve was popular with radio amateurs as a transmitting valve capable of about 200 watts CW output, and a reasonable quantity of the 100TH valves was available in Australia. The new design became known as the LW/AW MkII, and Fig.15 shows its transmitter.

Although the 100TH transmitter had a power output of 40-50kW, the design did not perform as well as hoped. Only 15 were built with the 100TH valves, as the shortage of VT90's was alleviated, and another 27 sets designated as MkII were made with VT90 valves.

Despite shortages of raw materials, STC at Alexandria eventually manufactured the VT90 (also called E1046) locally. Quantities also came through from the US, Canada and UK, to avert the supply problem.

Eight of the MkII transmitters with the 100TH valves were supplied to the Australian Navy as the A79 radar set, coupled to a six-element Yagi antenna. Incidentally the articles by John Moyle published in *Radio & Hobbies* in 1946 featured the LW/AW MkII transmitter, perhaps because amateurs would have been familiar with the 100TH valves.

Also during 1943, following further field experience and a visit by Mr Worledge to Papua-New Guinea, the tubular LW/AW frame and tent were en-

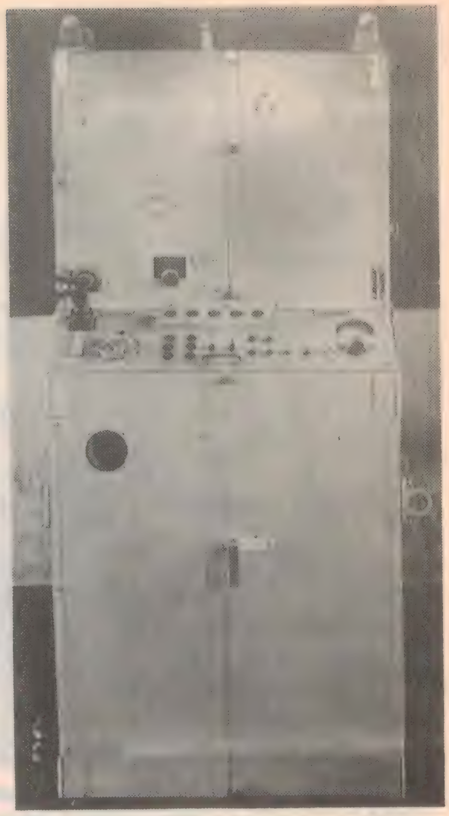


Fig.17: The MkIII transmitter, smaller than the MkI but producing 15 times more power. The MkIV was physically identical.

larged to improve operator comfort and to accommodate a new IFF interrogator called the BL4.

The original tent had only just enough room for the operator, and in the tropics with all that heat producing equipment it was most uncomfortable. Many operators worked in their 'birthday suits', with a pair of shorts close at hand in case of emergency.

The new larger frame was called the MkII, which confuses the issue with the MkII transmitter. The chronology of Australian designs becomes a little blurred here because equipment was being adapted, modified and shipped with whatever combinations of components was immediately available.

There were for instance LW/AW MkI sets fitted with MkII huts, MkIII sets in MkI huts, different receivers from the ASV production lines instead of the original MkI version, and various diesel and petrol power/generator units (often scrounged locally). Fig.16 shows two views of the enlarged LW/AW MkII tower.

Although these LW/AW sets were considered to be 'light weight', it is interesting to consider the makeup of a complete station based on the LW/AW MkIA configuration:

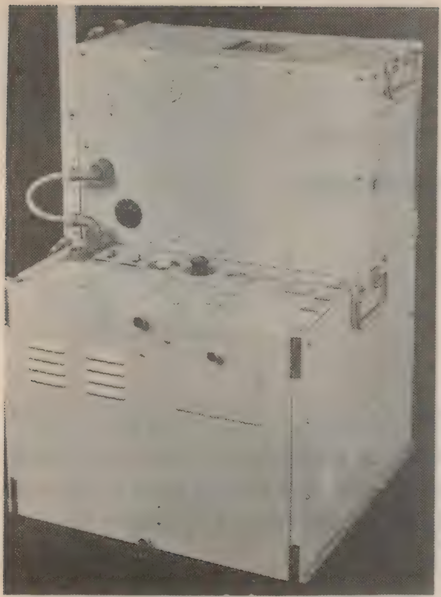


Fig.18: The MkV transmitter was even smaller, because it used a spark modulator. The rule indicates two feet, four inches (71cm) height.

Array, mast and hut (uncrated)	2600kg
Power supplies (uncrated)	1400kg
Transmitter (crated)	550kg
Receiver (crated)	450kg
Spares, test equipment	450kg
Interrogator and array	270kg
Wireless equipment, incl. batteries and charger	550kg
Jeep	1000kg
Armaments, tools, tents etc	360kg
Personnel (20, not incl. guards)	1800kg
Barracks equip. (non-technical)	10500kg
SO APPROX. TOTAL WAS	**21360kg**

It therefore required 9 to 11 aircraft to move a station — not including the food and fuel. One aircraft load of food and fuel lasted approximately 11 days. The total personnel strength for a typical radar station was around 45, including cooks, medical etc.

The number of guards varied, depending on how far forward the station was sited. A few were actually behind enemy lines, up in the Pacific area, and were allocated a large detachment of Army soldiers.

More power

In September 1942, the RPL developed a more powerful transmitter, designated as the LW/AW MkIII and using the newly available NT99 valves giving 150kW output.

The NT99 valve was a scaled-up version of the VT90, having the same length to maintain the internal capacitances, but larger diameters of all components and cooling fins, hence higher power capacity. Fig.17 shows the MkIII transmitter.

The MkIII radar had a 10us pulse and a PRF of 50 cycles per second, and worked on the common frequency of 200MHz. However only four units were made, because the RAAF was happy with the current MkI and MkII equipment and was hesitant to introduce another complication into their supply and training schedule.

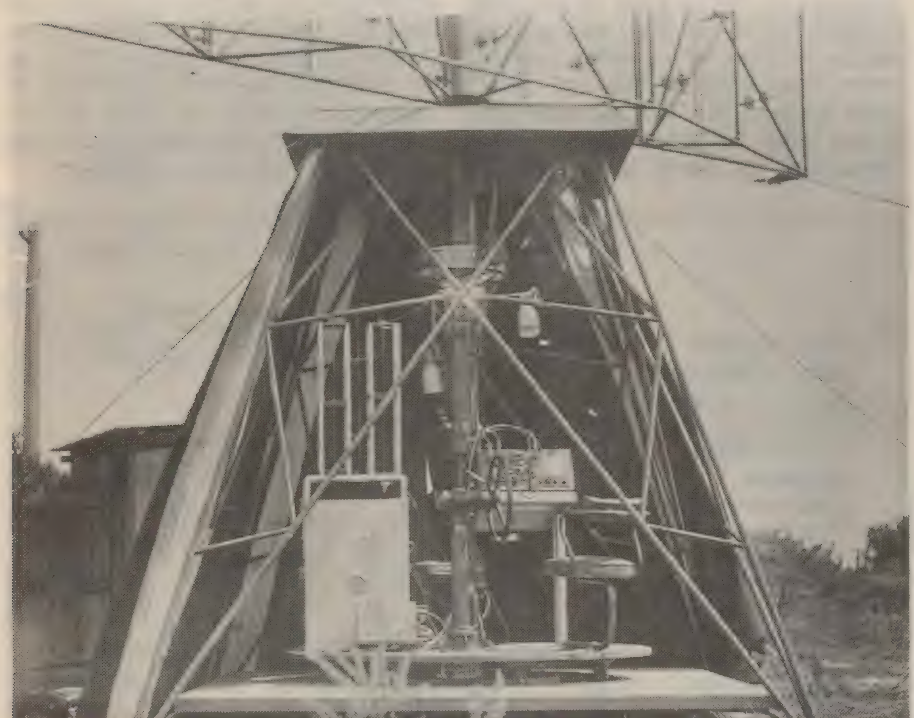


Fig.18A: The MkV transmitter along with an ASV receiver and A1 indicator in the MkI hut. The cramped conditions are obvious. Note how all the equipment is on a wooden turntable that rotates around the mast.

Two of the MkIII sets were sent to No.337 station at Los Negros in the Admiralty Islands for operational trials, where despite the extra power, they did not give substantially longer range than the MkI set.

The LW/AW MkII antenna array and hut were used with the MkIII, but the spacing of the open-wire transmission line had to be increased to prevent arc-over with the much greater power output.

A totally new transmitter was designed by RPL for the MkIII, smaller and lighter than the previous models. Spark gap modulation was used for further simplification, whereby an electric motor rotated a disk with two metal pins protruding so as to pass by an earth pin. A 12kV power supply charged up a Bartlett line, also known as a uniform line. It consists of a number of coils in series, with capacitors in parallel, which charges up to 20% higher peak voltage than the input DC voltage.

This stored energy was discharged when the rotating pin of the spark gap passed the end contact of the uniform line. The high energy pulse was fed through the cathode circuit of the NT99's in push-pull, to trigger them into oscillation for a fraction of a second.

Although this all sounds like an obsolete 1900's spark transmitter technique, in fact a number of WW2 radar sets used the principle as it was simple, effective and light in weight.

The AW MkI receiver was specified for the LW/AW MkIII transmitter, but by this date the RAAF was equipping stations with a complete ASV MkII receiver — the model AR301 modified to delete the normal aircraft Port/Starboard antenna switching, and a 125mm diameter Type A1 indicator scope with a perspex range scale fitted over the CRT face in place of the movable display trace and range potentiometer.

After the war, the AR301 was popular amongst radio amateurs who converted it to 2-metre operation. Many A1 Indicators also yielded parts for the first *Radio & Hobbies* TV set. An RF preamplifier with two low noise RL37 valves had been designed by RPL in mid-1942 and was fitted to the MkIII, but it also found its way onto other radar sets, particularly those with high towers and high line losses.

The RPL also experimented with an LW/AW MkIV, which was the MkIII transmitter but with a different PRF of 100 per second and pulse timing of

Continued on page 50

FORUM

Conducted by Jim Rowe

Fluoro lamp safety and fancy audio cables, both revisited...

Despite my attempts to give it a break, at least for a while, the debate about fancy speaker and power cables seems to have a life of its own. Obviously it's a topic with the ability to generate fairly strong views — in doubters as well as believers — judging from the letters and faxes that continue to roll in. I've also received some further information about the safety aspects of fluorescent lamps, a topic which seems almost as good at polarising reader responses!

You may recall that the reader who first raised the topic of a possible safety risk with fluorescent lamps, due to UV radiation from them, was Mr Frank Rushworth of Allambie Heights in NSW. Mr Rushworth's letter was published in the November column last year, and he made reference to a paper on the topic which had been published in *The Lancet* for August 7, 1982. In a later comment, I said that I'd like to read a copy of that paper, for my own interest and reference if nothing else.

As it happens Mr Rushworth himself has very kindly sent me in a copy of the paper, which was written by V. Beral, S. Evans, H. Shaw and G. Milton — at the time workers at the Department of Medical Statistics and Epidemiology at the London School of Hygiene and Tropical Medicine, and also the University of Sydney and Melanoma Clinic, Sydney Hospital. My thanks to Mr Rushworth for sending this in.

It turns out that the study began in mid-1978, and was carried out on 823 women in NSW — 274 of whom had been diagnosed with malignant melanoma; the other 549 were used as matched controls. All were given a questionnaire, the responses to which were analysed at the London School of Hygiene and Tropical Medicine.

The results were interesting, although as the authors noted there were quite a few aspects that were intriguing to say the least. For example the women who reported an exposure to fluorescent lighting at work seemed to have a doubled likelihood of contracting melanoma, compared with those that didn't, and this risk seemed to increase with increased duration of exposure. However women who had worked outdoors at any time seemed to have a *lower* risk than those that hadn't. The link between fluorescent lighting exposure and melanoma seemed to be strongest with melanoma lesions on the *trunk*, too — rather than those on the arms or legs, where you might perhaps have expected.

The authors of the paper discuss at some length possible explanations for the results, including differences in the spectral compositions of sunlight and radiation from fluorescent tubes; the habituation of skin to UV radiation in sunlight, which might possibly 'toughen' and protect it from the UV emitted by fluorescent tubes; the UV transmission properties of various kinds of women's clothing; and so on. They also suggest that the evidence of a possible link between fluorescent lighting and melanoma might explain why the incidence of the latter has more than doubled throughout the world, in the last 30 years. They close, however, with a note of caution:

This is, however, the first report of an association between melanoma and exposure to fluorescent light. The findings should be interpreted cautiously until further relevant data accumulate.

All in all, it's an interesting and thought-provoking study, although the fact that much of its data was derived from a questionnaire seems to make the findings a little 'softer' than one based totally on hard evidence.

Shortly after the arrival of Mr Rushworth's second letter with its copy of the paper by Beral *et al* (I hate that term, don't you?), I received a letter from Graeme Elliott, Information Officer at the Australian Radiation Laboratory in Yallambie, Victoria. Mr Elliot was responding to the discussion in the November issue, and wrote as follows:

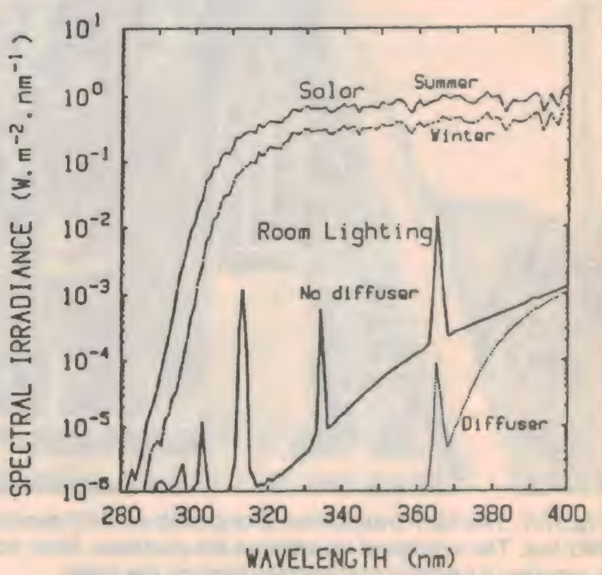
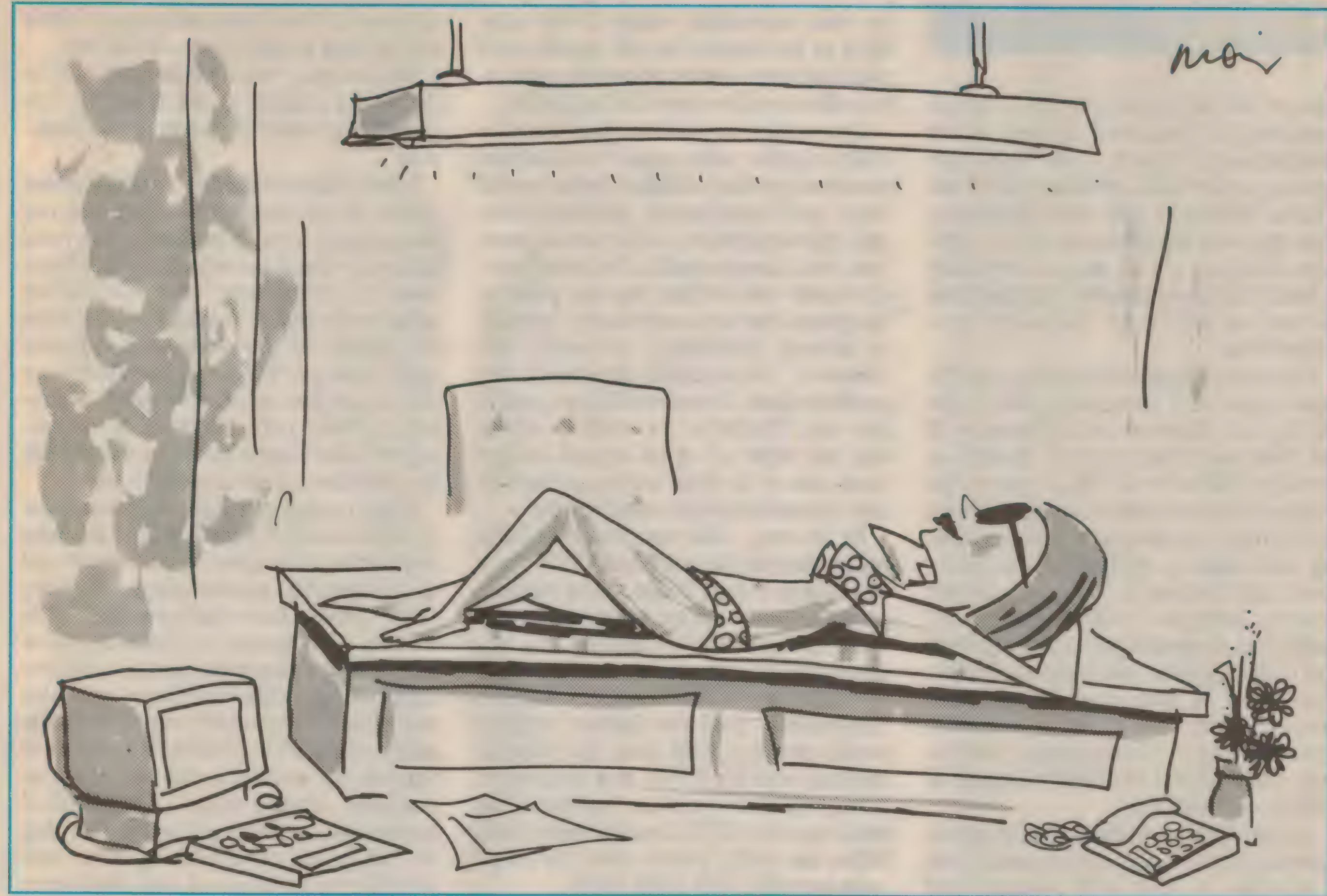


Fig.1: A graph given in the paper by C.R. Roy and his colleagues at the Australian Radiation Laboratory in Victoria, showing measured UV radiation from fluorescent lamps compared with that from the midday sun in Melbourne.



In the Forum column of November 1992, you published a reply to a letter from a Mr Rushworth regarding an alleged relationship between the incidence of malignant melanoma and the ultraviolet radiation (UVR) emissions from both long and compact fluorescent lamps.

A paper titled 'Malignant Melanoma and Exposure to Fluorescent Lights at Work', by V. Beral et al was referred to in Mr Rushworth's letter. This paper, along with with other papers on the topic, are discussed in the enclosed paper 'Malignant Melanoma and Fluorescent Lighting: Current Status', by C.R. Roy et al. This latter paper concluded that the observations of Beral et al were not confirmed by other studies.

In addition, the paper by Roy et al reports on measurements conducted by this Laboratory, of the UVR emissions from long fluorescent lamps. These measurements indicate that, according to the UVR exposure limits recommended by the National Health and Medical Research Council, the lamp emissions are not a hazard (the NHMRC limits are identical to the IRPA limits referred to in the paper by Roy et al).

Furthermore, UVR emissions from compact fluorescent lamps, which have not been measured by ARL, are discussed in the enclosed paper 'Hazard Assessment of Optical Radiation Sources Used in some Consumer Products', by A.J. Pearson et al, of the UK National Radiological Protection Board. These emissions are not considered a hazard either.

As Graeme Elliott says in his letter, he enclosed copies of both papers referred to therein. C.R. Roy and the other two authors of the first paper turn out to be workers at the Australian Radiation Laboratory, and in fact Mr Elliott himself is one half of the *et al*; the other half being an H.P. Gies.

In the first part of the paper, they summarise the results of a number of studies looking at the possible link between fluorescent lighting and melanoma, including the initial paper by Beral and her colleagues. They conclude that the later studies did not confirm the findings of Beral *et al*, and that further epidemiological studies are needed.

Following up suggestions made in both the initial paper by Beral *et al* and in a later paper by Maxwell and Elwood, about the possibly high intensity of specific UV wavelengths in fluorescent lamp emissions, Roy and his colleagues measured the spectral output from nine different long-tube fluorescent lamps available in Australia. This was done using a very fancy spectroradiometer system, hooked up to a microcomputer-based control and data acquisition system. Measurements were also made in the ARL building itself, with and without the standard plastic diffusers, and the UV radiation levels compared with that from the Sun in Melbourne, for both summer and winter.

As Mr Elliott suggests in his letter, they found that the UV radiation from all of the lamps was well below the IRPA (International Radiation Protection Association) maximum allowed effective level of 1mW per metre^2 for eight hours, when the measurements between 280 and 315nm ('UV-B') were weighted with the IRPA's 'biological spectral effectiveness function'. The lamp with the highest figure gave an effective UV-B figure of 120uW/m^2, or around one eighth of the IRPA maximum level, while that with the lowest figure gave only 9uW/m^2 — around one hundredth of the maximum level.

The spectra of virtually all lamps were dominated by the mercury emission lines at wavelengths of 297, 303, 313, 334 and 365nm; none of them had any significant output below 289nm, down to the lower measurement limit of 250nm. Hence the

'spikes' in the curve of Fig.1, which compares the measured spectral power distribution (weighted) of the fluorescent lighting in the ARL building (with and without diffusers) with solar irradiance. Note that with the diffusers, the UV radiation from the fluoro lamps is typically at least 1000 times smaller than that from the sun, at midday in Melbourne on a winter's day.

The second paper enclosed by Mr Elliott is also very interesting. This is the one by A.J. Pearson and colleagues, of the National Radiological Protection Board at Chilton in the UK. It reports the results of measurements on the emission levels from a number of 'domestic' lighting and heating appliances, including fixed and hand-held sunlamps, radiant heaters, halogen cooking stoves and flashlights, tungsten-halogen desk lamps and both long-tube and compact fluorescent tubes. In each case the measurements were made at a distance corresponding to 'normal usage', and assessed with regard to possible damage to both the skin and eyes.

As Mr Elliott says, the results given for compact fluoro lamps are not considered a problem. In fact both compact and long-tube fluoro lamps are listed as producing less than 0.01 (one hundredth) the maximum exposure limit for UV-A set by international bodies such as the IRPA, while the UV-B safety factors are 0.05 for the long-tube fluoro and again less than 0.01 for the compact fluoro. These are for an 80W long tube at 1.35m distance and a 20W compact fluoro at 0.65m distance, and in both cases for 8-hour exposure times.

So it looks as if both long-tube and compact fluoro lamps can be regarded as relatively safe in their levels of UV-A and UV-B emission, at least according to the measurements of both the Australian Radiation Laboratory and the UK's NRPB, and using the safety levels specified by the IRPA and other international bodies as a guide. Which is fairly reassuring, of course, although international safety levels for various things have been known to be revised downwards from time to time, as more becomes known about their cumulative effects. This has happened with X-ray dosage, I think, as well as with acceptable levels of many organic chemicals used for crop spraying, pest and weed control.

Perhaps we can be reasonably relaxed for the time being about fluoro lamps in our homes and offices, then, while keeping in the back of our minds the possibility that acceptable safety levels may need to be lowered in the future when more becomes known about the cumulative effects of low-level UV radiation.

I guess this is much the same situation which applies with regard to low-level electromagnetic radiation from power lines, pole transformers, bedside clocks and other equipment. I don't know about you, but I always tend to be rather wary of experts who declare that *any* piece of equipment has been supposedly 'proved' to present 'absolutely no health risk whatever'. The scientific data rarely supports that kind of over-confidence, and in any case Murphy's law tends to ensure that this kind of claim almost *always* turns out to be dead wrong, sooner or later. Sometimes with tragic results...

By the way, I did note that the NRPB report showed that unfiltered 20W tungsten-halogen desk lamps could produce up to 5.3 times the recommended maximum dosage of UV-B radiation, at a distance of 0.3m and over an 8-hour period. Similarly even 20W tungsten-halogen 'luminaires' used for feature lighting could produce well over the recommended limit for UV-B, at a distance of 0.5m, when they too are unfiltered. In both cases the UV-B levels dropped well below the safety levels when the lamps were provided with glass filters.

This supports other studies I've seen reported, which suggested that UV radiation from unfiltered desk lamps using tungsten-halogen lamps could well pose a significant risk.

Back to cables

Now I suppose we'd better return to the topic of fancy audio and power cables, because as I said in this month's introduction, it's a topic that simply won't go away. Both the protagonists and the antagonists seem to have strong feelings about them, and the twain very rarely seem to be able to meet. Hence whenever I publish something brought up by one side, it generates a crop of responses from the other — and vice versa. Ah well, I suppose it keeps on providing regular grist for the Forum mill, at least...

This month's first letter in this context comes from Mr Dan Dempsey, of Oatley in NSW. You may recall that I presented a letter from Mr Dempsey in last September's column, having a go at those of us who were skeptical about the claims made for a particular brand of fancy power cable for hifi amplifiers. Mr Dempsey was the one who accused me of pontificating, a suggestion which no doubt generated some mirth in anyone who has come to know me even moderately well. There's probably many labels they'd want to apply, but not that one...

Mr Dempsey was a bit disappointed in the way I reacted to his letter, so I'm giving him a chance to correct the situation:

Given the provocative opening paragraphs of my letter, your serve was not unexpected, though methinks you read rather too much between the lines. I am, however, disappointed that you did not mention the money back guarantee from the retailer of the controversial power cable (vide my 'PS') — a fact that I was able to confirm with a 20-second anonymous phone call. As there is an impugned charlatan element in this debate the guarantee is not a trivial point.

When I suggested a demonstration/test of cable sound, I kept it brief expecting that further discussion would thrash out an acceptable methodology. Perhaps what I should have said was that I was willing to arrange a demonstration which proved that some *people could reliably pick the difference between cables that measure essentially the same in the audio bandwidth. Naturally I assumed that the test method would be, as far as practical, 'double blind'. The practical constraints are imposed by the fact that the cables are physically different, and somebody must connect and disconnect the cables during the test. However if you were to supply the person to do the switching and the audience could not see the cables, the test would surely provide a fair indicator on 'cable sound'. I would expect you to examine the cables beforehand and the equipment to make sure there was no subterfuge.*

Finally, I totally agree with the proposition that 'humans have limitless ability to fool ourselves', but this works both ways: is there the slightest chance that your expectations have influenced your conclusions (to date) in this matter? My offer to arrange a demonstration of cables remains open.

PS: Battery powered preamps have been around for about fifteen years (as best I can recall). The main criticism of them in the past concerned the (subjective) high frequency performance, which was not up to the standard of the best conventional mains powered preamps.

PPS: The controversial power cable has a plastic braided sheath over the usual double insulation — another fact that a 20-second phone call could confirm.

Well, there you are. I've reproduced virtually all of Mr Dempsey's latest missive, including the two post scripts, lest I be accused of censoring out any important points this time.

I doubt if there's any need for me to make much comment on it, apart from noting that somehow Mr Dempsey seems to think that because I present letters in Forum expressing different viewpoints, I somehow have the obligation to verify personally the truth of all claims made. Unfortunately if I tried to do this, I'd probably never get anything else done — and with the very small editorial staff we have nowadays to produce magazines like *EA*, that would mean there wouldn't be all that much else in the magazine!

No doubt I should also respond to Mr Dempsey's question about whether or not I too could possibly be guilty of fooling myself. The funny thing is that I've already answered it, in the very September column which prompted his second letter. In fact it was in the precise sentence where I talked about we humans having an almost limitless ability to fool themselves. My exact words were: "ALL of us, ME included". Why Mr Dempsey has chosen to not see this bit is beyond me.

I'm obviously just as much at risk of fooling myself as anybody else. But I know I'm by no means alone, when it comes to being highly skeptical about the likely beneficial effects of a short length of some 'special' power cable, substituted for the very last link in the chain between the power station and someone's hifi system. So in this case if I *am* fooling myself, I'm in pretty good company.

Sent papers

Moving along, another reader who has written in more than once on the general topic of audio cables is our old friend Phil Denniss, of the Department of Plasma Physics at Sydney University. In fact Phil has sent in two separate letters since the September column appeared, and in the second case he was kind enough to enclose copies of relevant papers he has come across in the literature. I'm very grateful to him for this, as I found the papers most informative.

Mr Denniss's first letter is rather long, and was pretty scathing about some of the statements made by Dan Dempsey. This being the case, and in the interests of better relations between the two camps, I hope Phil won't be too upset if I prune it rather severely. In fact I'd like to present only two relatively short quotes, which come after he has discussed the likelihood that earth loop problems could be responsible for any observed 'dramatic and unmistakeable improvement' when a cable is used:

Given all this, my recommendation to Dan Dempsey and those that hold similar views to this, is that if fancy cables really do make a big difference to the sound quality of his system, then he should plug a spectrum analyser into his system and find out what really is chewing up his signal. If the improvement made by fancy cables is so subtle that one has to listen very carefully for a long time, then Mr Dempsey is fooling himself... ... the 'unmistakable' effects Dan Dempsey refers to in his anecdote about an electrostatic speaker could easily be caused by earth loops, considering that the speakers are probably earthed to the mains through their power supply and also through the driving amplifier.

If during the test the system was turned off and the cable was replaced, then too much time would have elapsed to make a valid comparison. If the aforementioned effects were easily measurable, then something is grossly wrong with the wiring. If two sets of speakers were used, then the differences would most probably be caused by differences between the two sets of speakers... ...Let us see some real evidence, some facts — not just opinions of the listeners.

These were some of the milder bits of his letter, too! By the way, I have to admit that like Phil Denniss, I have considerable reservations about the kind of A-B testing proposed by many of the protagonists of the fancy speaker cables. I forgot to mention this earlier, in response to Dan Dempsey's second letter.

From his reference to 'practical constraints' and the need to 'connect and disconnect' cables during testing, I suspect Mr Dempsey is against any kind of switching system that would allow true A-B testing in real time. Certainly other people in the fancy cable camp have been aghast at the idea of introducing switching; some have even declared that in their opinion, this would render such a test totally invalid.

Unfortunately it's hard to see how valid comparisons between cables *could* be made, if there had to be significant pauses while cables were physically changed. The generally accepted idea of A-B testing essentially involves being able to change between the things being compared in real time, so that they can be compared directly at many different instants.

There's something of a dilemma here, it seems. The kinds of test proposed by people on each side seem to be unacceptable to those on the other...

One of the papers which Phil Denniss enclosed with his second letter was by Fred E. Davis, a consulting engineer in Connecticut. Entitled 'Effects of Cable,

THE CHALLIS REPORT

Continued from page 23

released in the United States as I write these words, and is predicted to reach Australia by late March.

Even if you don't ever to get to see the NT-1 recorder itself, I think I can safely promise that the NT-2, and subsequent generations of this technology will change the way in which you use tape recorders. More importantly, they're likely to change what we have all come to expect from tape recorders.

The NT-1 Scoopman Digital Micro Recorder measures only 113 x 55 x 23mm, and weighs a mere 147 grams. Its anticipated price, from the specialised dealerswho will be handling it, is $2000.

Further information should be available from Sony's dealers, but in case of difficulty you can contact Sony Australia, 33-39 Talavera Road, North Ryde 2113; phone (02) 887 6666. ❖

NOTES & ERRATA

GAUSSBUSTER (July 1992): We have been advised that the expression given in Fig.3, for the field intensity B at the centre of a square loop of side w (and area w^2) should read:

$B = \mu_o.n.I.2\sqrt{2}/\pi w$

The minor error in the expression as originally published does not affect the calculation for a coil with sides of 1m long, as suggested in the article. However the revised expression shown here should be used if the coil size is significantly altered.

INDUCTANCE ADAPTOR (December 1992): With the schematic as shown, the DC offset adjustment is extremely sensitive. This can be remedied by connecting a 100-ohm resistor from pin 3 of IC6 to ground (power supply common). If desired, the zero stability can be improved by adding a second TL431 voltage regulator to stabilise the Vcc rail as well as the Vss rail. Capacitor C3 should be 1.2nF, not 330pF, and it should be a polystyrene or polypropylene component for stability.

The output on the 'low' range is 0.1V (100mV) for an inductor of 1mH, not 1.0V as stated. Also the nominal operating frequency for the adaptor's oscillator is 5kHz, not 10kHz. The nominal voltage at test point A is around 1.5V p-p, varying inversely with frequency when the inductance calibration is correct.

DSO ADAPTOR FOR PC's (February 1993): With the printer port of some PC's, it may be necessary to add a 1nF ceramic capacitor between pin 1 of the DB25 connector and ground, to prevent double clocking of the counter.

FORUM

Loudspeaker and Amplifier Interactions', it was published in the June 1991 edition of the *Journal of the Audio Engineering Society* (Vol.39, No.6). In it, Mr Davis reports on the results of quite extensive testing of 3.1m lengths of 12 different types of cable used for connecting loudspeakers to amplifiers — ranging from low-cost 'zip' cable (what we call 'figure-8 power flex') and heavy car 'jumper leads' right through to co-ax, woven and very fancy multiple-diameter cables costing US$419 per metre. Mr Davis also develops an electrical model for a speaker cable, and uses this to explain some of the results.

Probably the best way to summarise Mr Davis's findings is to quote from his conclusions:

If loudspeakers were only simple resistance, then large, low-resistance cables would not be a bad idea. However loudspeaker systems exhibit a frequency-dependent complex impedance that can interact with the reactive components of amplifier and cable. The best response was obtained with low-inductance cables and an amplifier with low-inductance output and a high, frequency-independent damping factor.

These tests have shown that the best way to achieve adequately low resistance and inductance in a cable is by using many independently insulated wires per conductor rather than one large wire. Efforts to reduce the skin effect (such as Litz construction) will help, but due more to the reduction of inductance than the reduction of the skin effect. Inductive reactance is more significant in large cables than the skin effect...

Although the cables which gave the best performance overall were those with multiple insulated conductors and a ribbon configuration, having an equivalent copper cross-sectional area of about 8 AWG, Mr Davis basically seems to conclude that heavy-duty 'figure-8' flex (he quotes 65 strands of 30 AWG) is more than sufficient for most purposes:

Of the two-wire cables, 12 AWG provided the best performance with reactive loads... 12 AWG seems more than adequate, even for demanding systems, high power levels and reasonable lengths... Though not as linear as flat cables, 12 AWG wire works well and exceeds the high-frequency performance of other two-conductor cables tested. By the way, keep the auto jumper cables in the garage!

By the way, both Phil Denniss and I noted with some amusement that the very costly multi-diameter 'constant velocity' US$419/metre cable didn't even rate a mention in Davis's final score card, because its measured performance was no better, and in some cases inferior to that of much cheaper cable.

Among the other papers sent in by Phil Denniss were a paper by Professor R.A. Griener of the University of Wisconsin, titled 'Amplifier-Loudspeaker Interfacing' and published initially in the *Journal of the Audio Engineering Society* (May 1980, Vol.28 No.5), together with an updated form of the same paper which was republished in the August 1989 issue of *Audio* magazine. Professor Greiner seems to come to much the same conclusions as Mr Davis, incidentally.

There were also papers by Jeffrey H. Johnson ('Power Amplifiers and the Loudspeaker Load', in *Audio*, August 1977), and joint authors Matti Otala and Pertti Huttunen ('Peak Current Requirement of Commercial Loudspeaker Systems', in *J.A.E.S.*, June 1987, Vol.35 No.6). The latter paper was especially interesting, because it concludes that the loading impedance presented by typical '8-ohm' loudspeaker systems can fall dynamically down to around one ohm — calling for peak currents over six times larger than would be needed for driving an 8-ohm resistive load, with durations of up to a few hundred microseconds.

All in all, then, I'm very grateful to Phil Denniss for sending the copies of these papers, and I can recommend them to anyone seeking further information on this controversial topic.

But that's about all we have space for, this month. There are quite a few other letters on the broad subject of fancy cables and the like, but these will have to wait for a while. ❖

WHEN I THINK BACK

Continued from page 31

multiple amplifiers and strategically located control centres. While the prime function of the installation was to allow spectators to share in the progress and the events, it was interlinked with PMG, press, radio and newsreel services, and to the police and fire brigade for crowd control and/or emergencies. Sufficient back-up equipment had to be accessible to cope with any possible malfunction.

As if all this was not problem enough, Nomis had been commissioned by the Tasmanian Government to provide sound coverage for Hobart and Launceston, just two weeks previously. This had involved air-freighting nine miles of street wiring and 120 loudspeakers, with the intention of sending a control van and sound tower by sea. At the last minute these, too, had to be despatched on a specially chartered Bristol freight plane.

With all this going on, it may come as a surprise that Laurie Simon still found time for community activities — as, for example, a member and chairman of local kindergarten and college committees. A member of the IREE (Institution of Radio & Electronics Engineers), he also served as a president of the SA Division.

Again, he was a member, committee member and past president of the BREIF Club (Broadcast Radio Electrical Industries Fellowship) supporting under-privileged children. And as a member, committee member and past president of the Rotary Club of Unley, he also helped formulate Rotary at Mt Barker. Last but not least, Laurie was elected to the Unley City council in 1963 and served as mayor for two years. His wife Yvonne has also been an active participant, in her own right, in community affairs.

Seven years ago, at age 72, he retired in time to celebrate their golden wedding anniversary, with their four sons and their own families. He also sold up his business, which now operates under totally new management as 'Network Nomis'. With new and enlarged premises at 51 Glen Osmond Rd, Newtown, Laurie says it is "a very professional audio-visual company". He is obviously happy that they are keeping alive his family name — even if, as ever, it is still being spelt backwards!

Due to lack of space, I am holding over a number of anecdotes from Laurie's memoirs. All being well, we should be able to publish them next month.

(To be continued) ❖

NEW KITS FOR EA PROJECTS

Jaycar Electronics has advised us of its release of new kits for the following recent EA projects:

HIGHER POWER SUBWOOFER (January 1993): Jaycar is stocking a complete cabinet kit, made from 18mm MDF customwood, with all holes drilled and with a plain wood finish ready to paint. The kit has the catalog number CS-2485 and is priced at $189. The driver is sold separately for $199 (CW- 2145).

DSO ADAPTOR (February 1993): Jaycar's kit is complete with PCB, box, IC sockets and front panel. It has the catalog number KA-1748 and is priced at $85.

50MHZ FREQUENCY COUNTER (February 1993): Jaycar's kit is complete with 1% metal film resistors, MKT capacitors, instrument case and pre-punched, silk screened front panel, with red perspex display filter. Catalog number KA-1749, it is priced at $89.50.

NOTE: This information is published in good faith, from information supplied by the firm or firms concerned, as a service to our readers. Electronics Australia cannot accept responsibility for errors or omissions.

THE SERVICEMAN

Dried up electro's, dud parts and dangerous mods by dingalings!

We certainly have a mixed bag for you this month — no less than four different stories, from three contributors as well as yours truly. One story involves an incredible case where one section of a set had apparently had three dud parts out of a total of four, when it left the factory, yet worked quite well for some years before finally failing!

Our first contributor is a newcomer to these pages. He is B.C., of Mt Rumney in Tasmania, and quite frankly I like his conservationist attitude. So many small appliances are throw-away items these days, yet as B.C. shows us, many can be resurrected with just a little TLC ('tender loving care', in case you didn't know).

This is how he tells the story:

I always turn to your stories each month when EA arrives, and I find them a constant source of amusement and very useful information.

By profession, I am a process control systems engineer and after 15 years of industrial development and maintenance, only rarely do I dabble in the odd spray timer, sprinkler sequencer, etc. So although my 'servicing' experience is minimal, the following story may be of interest to readers.

It concerns a Kemtronics clock radio model DE221, which we purchased originally because it did not sound like an old horn speaker in a kerosene tin. The radio had given excellent service, apart from a leaky dimmer transistor some years ago, until recently when it started to switch on in the middle of the night.

My better half was not amused when all the display segments would come on without warning. Sometimes, a carefully judged tap on the side of the case would cure the fault. At other times it would come right without physical aid.

Several fruitless excursions to the workshop failed to locate the fault, because Murphy saw to it that the set would always work perfectly out of its case, and for several days afterwards.

Finally, on a wet and miserable day when the radio had failed to respond to physical and verbal abuse in the middle of the night, I set to with pad and pencil to trace out the circuit and find the fault.

I reasoned that it was mains ripple on the DC supply, since the clock display segments were all on together and flickering slightly. There was also a faint buzz on the audio, which disappeared when the display came good. The clock would respond to all the function select switches except the fast and slow advance controls.

The power supply comprises at least six half wave rectifiers, filtered for the radio, clock IC and the display, and unfiltered for the dial light and other loads. These are all supplied from a small transformer with two windings of about 9V and 11V, to a single common.

The DC to the display appeared to be a bit low at 3.5V, and the IC supply measured only about 6 volts DC. I puzzled about these as I tried to trace the circuit, since they seemed more appropriate to late 80's MOS technology than to the early 70's TTL when this set had been new.

And why such high AC supplies for low DC outputs? Where was the voltage being dropped?

I had no information on the clock IC, a 9817DPC, made about 1976. So I stoked up the old Cossor CRO and began to check the DC rails for ripple. Sure enough, I found chunky half-wave patterns, with not much smoothing on the display supply and even less on the clock rail.

It was quickly out with the soldering iron and desoldering braid and off came the RB style electrolytics. There was a 1000uF 16V for the display, and a 470uF 25V for the clock IC. As I pulled the latter from the circuit, I was relieved to find that one pin stayed behind in the board. That was the cause of the intermittent!

New capacitors soon restored 12 volts to the display and 15 volts to the clock IC. Now all works properly and we can sleep on undisturbed.

I didn't work out the circuit diagram, unfortunately, but then I had solved the problem so it wasn't so important.

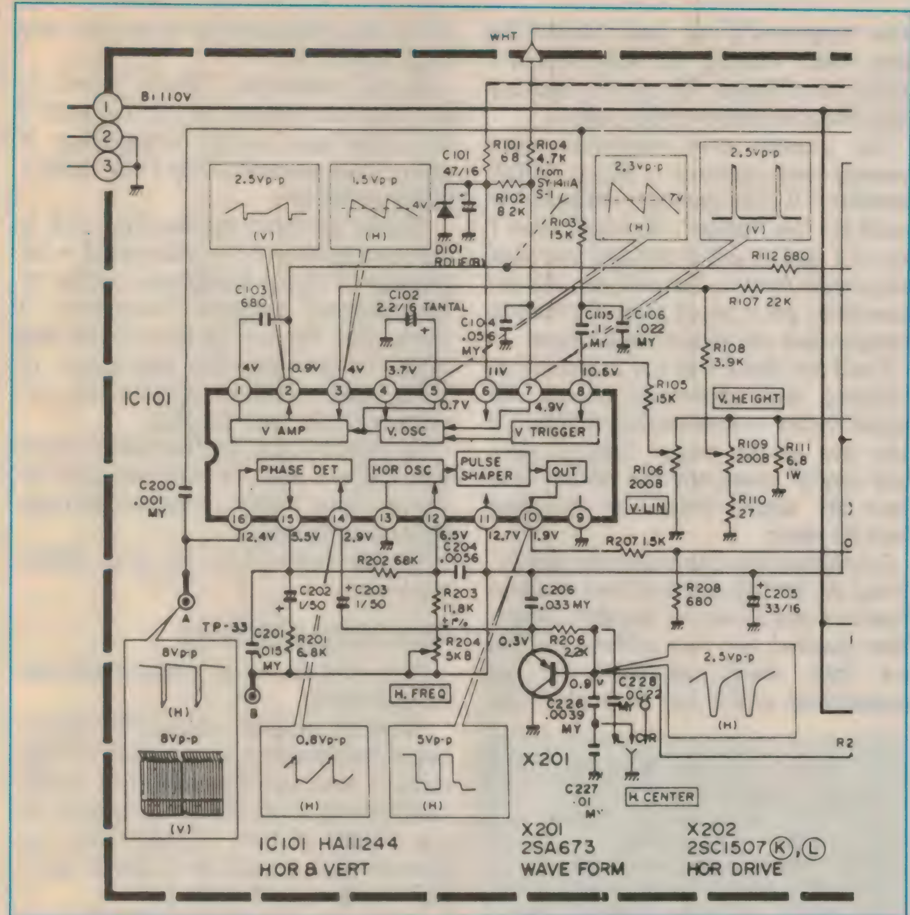
From now on, I'll believe ALL your stories about dried up electros, and I'll change them as a matter of course.

Thanks for that little item, B.C. It reinforces my opinion that next to mechanical bits and pieces, electrolytics are the most unreliable components in any electronic devices. They are always the first thing to look at whenever an appliance shows a malfunction rather than a total failure.

Unlikely coincidences

Our second contributor this month is the well-known L.K., of Daintree in FNQ — sorry, far-North Queensland.

L.K.'s customers continue to present him with the most obscure problems im-



Frequent contributor L.K., from Daintree in FNQ, writes this month about an HMV model A4301 colour set which had a rolling picture. Here is the vertical and horizontal sweep chip IC101 and most of its circuitry, for reference.

aginable, and this story is no exception. In fact, it must go down as one of the most improbable faults ever to be presented to any serviceman. See what you think:

The feeling that it was going to be one of those days came over me as I changed a flat tyre on the way to open the shop.

My delayed arrival was greeted by an agitated customer, who informed me that he also was now late for work! In great haste, he placed an HMV model A4301 colour TV at my feet and complained of a rolling picture. He added that the vertical hold control had not worked since the set was purchased, about three years previously. But as the set had been otherwise satisfactory, he had never got around to having it fixed.

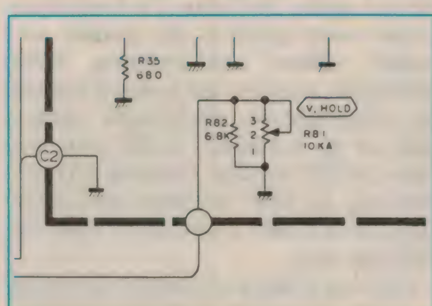
Then he sort of — dematerialised!

Some time later, with the set open on the bench, the fault was verified. It had a slow roll, and the vertical hold control certainly did not function.

A closer inspection revealed the reason — or at least I thought it did; the potentiometer's rotor arm was completely missing! Considering the condition of the set (there was no sign of any previous repair work) and the absence of any fragments amongst the dust, I was obliged to conclude that it had indeed been purchased in this state. Even this revelation, however, failed to trigger a warning bell. As noted earlier, it was going to be one of those days. Because after replacing the control, I was left with exactly the same symptoms: a slow roll and the vertical hold still ineffective.

"Time to start thinking", I mused, while sipping on a cup of no-longer hot coffee.

The only other components in the hold



R104 in the circuit above connects to the off-board vertical hold control pot, shown here.

circuit, excepting the IC, were two resistors and a capacitor. Checking R104 gave a reading way above the 4.7k called for in the circuit. But on removing it from the board, I discovered that it was not in fact high at all. Rather, it was a 470k and measured spot on!

So! Which was wrong, the circuit or the component? The ratio of 470k to the approximate 5k of the hold pot would have to be far too high, and therefore the circuit was most likely correct.

Fitting a lower value certainly made a difference, for now the picture was rolling at great speed. And although the control also functioned, it was not in the event when it came to stopping the gyrations.

A check of R102 (8.2k) came up A1, as did the +8V source. "Why me?" I muttered, at the now-cold dregs in the coffee cup.

After experimenting for some time with different values for R104, it became apparent that the only way the picture would lock was with the resistor right out of circuit. Where to go from here?

The possibility of a faulty chip had not been overlooked, but I couldn't give the idea enough credence to carry it any further. At this point my bio-rhythm cycle must have bottomed out, because things started to go right for me. The one component that had so far gone unchallenged was C104. In a moment, I had it lifted clear and checked for leakage. Bingo!

It measured out at a neat 7k ohms. So I fitted a new capacitor, refitted the correct value for R104, and the set was performing as it should have done three years previously.

But what a chain of 'coincidi', to have allowed a set to pass all the inspections, sales checks and customer satisfaction, yet have from new, three faulty components in a four component circuit — and still outwardly operate normally!

It would appear that the leak in the capacitor was of the right value, and sufficiently stable to hold the picture in lock. And the incorrect value of R104 was sufficiently high to mask any effect the hold control might have had, had it been working anyway. Not until the capacitor drifted in value did any sign of trouble show up.

I'm happy to report that I had no trouble wending my way home that evening, and my bio-rhythm cycle has continued its upward trend!

Well, that story must take the cake! I've heard of, even come across, wrong value components in new equipment. But I could never imagine a scenario like

L.K.'s, with 75% of faulty circuit elements in a circuit that still worked!

That's the sort of nightmare that busy technicians can do without. Thanks, L.K. — we are looking forward to your next joust with the un-believable.

'Death-trap' mods

Now we come to another newcomer to these pages. This next story is not about a servicing job as such, but comments on a previous item, about live-chassis TV's. It comes from R.P., of Pambula Beach in N.S.W. He writes thus...

I have just read your Serviceman column in the March edition of EA and I felt compelled to write to you about some experiences I have had with respect to live-chassis TV sets.

I should perhaps preface my comments by explaining that I have been servicing television sets since 1956, and whilst I would never consider myself an expert (a word I don't like anyway) I do believe I have a modicum of experience.

Like yourself, I have had many funny and unusual experiences over the years. Yet it never ceases to amaze me how many people 'know what's wrong' with their TV or video, and come close to causing themselves serious injury by attempting to fix or modify equipment they know nothing about.

The reason for this epistle is your comment (after A.K.'s story re the Sony KV2764) about live-chassis TV. And to illustrate how stupid the ignorant public can be at times, I would like to recite three stories that I have experienced over the years.

The first and probably most graphic happened about 12 years ago and concerns a German Blaupunkt colour television, a model called 'Manila' which used a live chassis.

I was called to repair this set and the customer explained that the set blew up when, after viewing the night before, his wife had hung up the headphones she was using on the metal standard lamp next to her chair.

It turned out after some questioning that, yes, he had decided to save a few dollars and fit the headphones to the TV himself. And yes, he had simply wired them straight across the speaker terminals. The headset was of the older variety, with a bare metal headband that sat across his wife's head.

Apparently, the night before he had moved the standard lamp closer so she could see to knit. When I explained how lucky she was to be alive, and what might have happened if she had touched the lamp while wearing the headphones, I think I cured him for life of ever tinkering with things he knows nothing about.

The second story happened more recently and concerns a Sharp 9C140 portable TV. The customer brought the set in for 'No Picture'. However, when I saw it I had to ask if she had ever had any shocks from it. She said yes, she did sometimes get a shock from the built-in aerials when she tried to adjust them.

I told her that I was not surprised, as someone had apparently broken the aerial socket — and instead of fitting a new one of the proper isolated type, had simply connected the ribbon lead from the aerial directly to the coax from the tuner.

I explained that every time she had adjusted the aerials, she had been at mains potential and it was no wonder she had been shocked. She then told me she had not long since purchased the set secondhand, and it had been wired this way when she bought it.

I wonder how the previous owner would have felt, if the lady had died from electric shock due to his stupidity and ignorance.

The third story occurred earlier this year and concerns a Philips KT3A chassis and again, the fitting of a headphone socket wired direct to the speaker terminals without any isolation. What makes this story special is that it's about an inexperienced, fly-by-night person who set up in business in this area just prior to UHF starting. He made a bundle throwing up UHF antennas and doing some service, then closed down when the rush was over.

(The last I heard of him, he was going to move interstate and sell ultralight aircraft, because he couldn't stand dealing with the public! I can only say that if he applies the same amount of expertise to his new profession, he won't last very long there either!)

In the meantime, I have fitted an isolation transformer to the customer's set so he can use his headphones in safety. I am pleased to say I now have a customer for life.

Fault of the Month

SHARP VC9100 VCR

SYMPTOM: No go. No sign of life — no clock, no standby, no anything.

CURE: Check power supply regulator board for a thick brownish deposit. This was once a rubbery glue used in the factory to hold components on the board before soldering. With age, it has degenerated into a conductive coating which shorts out various components. Scrape or chip the goo off the board, and the machine should come good.

This information is supplied by courtesy of the Tasmanian Branch of The Electronics Technicians' Institute of Australia (TETIA). Contributions should be sent to J. Lawler, 16 Adina Street, Geilston Bay, Tasmania 7015.

Thanks for those recollections, R.P. It just goes to show how widespread is the practice of fitting headphone outlets by inexperienced persons. Fortunately, it seems that the era of live-chassis sets might be passing. The prevalence of video input sockets on modern sets presupposes an isolated chassis.

So with any luck, the live-chassis types will die out and we will not have to worry about losing customers through their own stupidity.

Thanks again, R.P., for your timely reminder.

Blanking problem

Now we come to my own contribution for the month.

Since the local commercial TV station began broadcasting an extended teletext menu, I have heard a number of people complaining about flickering lines at the top of their picture. I haven't seen the phenomenon myself, or I should say I *hadn't* seen it, until yesterday.

The set was a National TC1807, fitted with a PBA-M9 chassis. This is a middle-aged chassis and one that has given good service, if its infrequent appearance in my records is anything to go by.

In this case, the set was delivering a perfect picture from the ABC and SBS transmissions and, except for the teletext lines, it was showing a perfect pic from the commercials.

In many respects, the fault could be mistaken for flyback lines, except that they were only visible at the top of the screen. All-over flyback lines are usually caused by a spikey second anode voltage, the result of a dried-out filter capacitor. The teletext lines are revealed when this happens, but are accompanied by other lines lower down the screen.

In this case the lower lines were not visible, even with the A2 voltage turned right up. So this could only be a blanking problem; and to begin with, I imagined that it would be easy to fix. I was about to be taught a lesson.

Practically all of the blanking in this set is carried out in IC301, an AN5610N on the 'B Board'. It is supplied with horizontal and vertical pulses at pin 5, and properly blanked video should emerge at pins 6, 7 and 8. My need was first to determine if the pulses were present and correct, then to decide if the chip was defective.

I began on the B board at the point where the lead from plug CO53 was attached. These connections are labelled B1 to B6 (at the bottom left corner of the diagram). The horizontal pulse enters on B3 and the vertical pulse on B6.

The waveform for the individual pulses is not given in the manual, but what I found did make sense.

The horizontal pulses go straight to an isolating diode, D601, but the vertical pulses go first to a pulse shaping network comprising R615, R616 and C625. This last item interested me, since it was a 3.3uF electrolytic and these low-value devices are notoriously unreliable.

I replaced the capacitor with a new one, and while it was out of circuit I took the opportunity to check the two resistors. The entire exercise was a waste of time, since the teletext lines continued to flicker away, quite unaffected by my attentions.

After the wave shaper the pulses go through an isolating diode, D603, and unite with the horizontal pulses. From there they go up toward the IC. I checked all the diodes in this area, but none showed any sign of malfunction.

Just before the pulses enter the IC, they have to negotiate a divider network of R306 and R316. Needless to say, neither of these resistors were defective in any way that I could determine.

In fact, up to this point it would seem that there was absolutely nothing wrong with any part of the circuit, since a waveform at pin 5 is given in the manual, and I could see a waveform identical to within 0.1V of that shown!

This left only the IC, a 16-pin device with a two pin heatsink attached. I didn't have a spare in stock, but I did have one in a known good board among my junk. So, it was a matter of unsoldering two chips to effect a changeover, which didn't take all that long. But all to no avail. The picture continued to show the teletext lines without any sign of improvement.

Now I really was in trouble. I had spent almost an hour on the set and had got precisely nowhere! If I returned the set unfixed, I could hardly charge the customer. Yet if I continued for much longer, my labour charge would begin to look uneconomical.

I swallowed my pride and rang a colleague, who is well versed in the theoretical side of colour TV. I put to him the symptoms and details of all that I had done so far. His answer was immediate and not at all welcome. He believed the trouble to be a matter of design, and not one of a faulty component.

The TC1807 and other chassis of similar vintage were designed before the teletext specifications were laid down. As I understand the explanation given to me, designers then were only concerned with suppressing the normal flyback lines. These are normally black and could be masked by simply setting the black level to an appropriate value, so no great importance was placed on blanking the video at the same time.

It seems that there are quite a few sets with this problem in the field, and not just Nationals. Any chassis that lacks an accurate vertical interval blanking system is likely to show these teletext lines.

(I've just had a call from a colleague with the same problem in a Graetz set. This is a top-of-the-line German television, so the trouble is not confined to bottom-end designs.)

Anyway, I was faced with a dilemma. I had to do something for the customer, or I would lose the hour and a bit that I had already expended on the job. So I decided to re-design the set, to see if I could improve the vertical blanking.

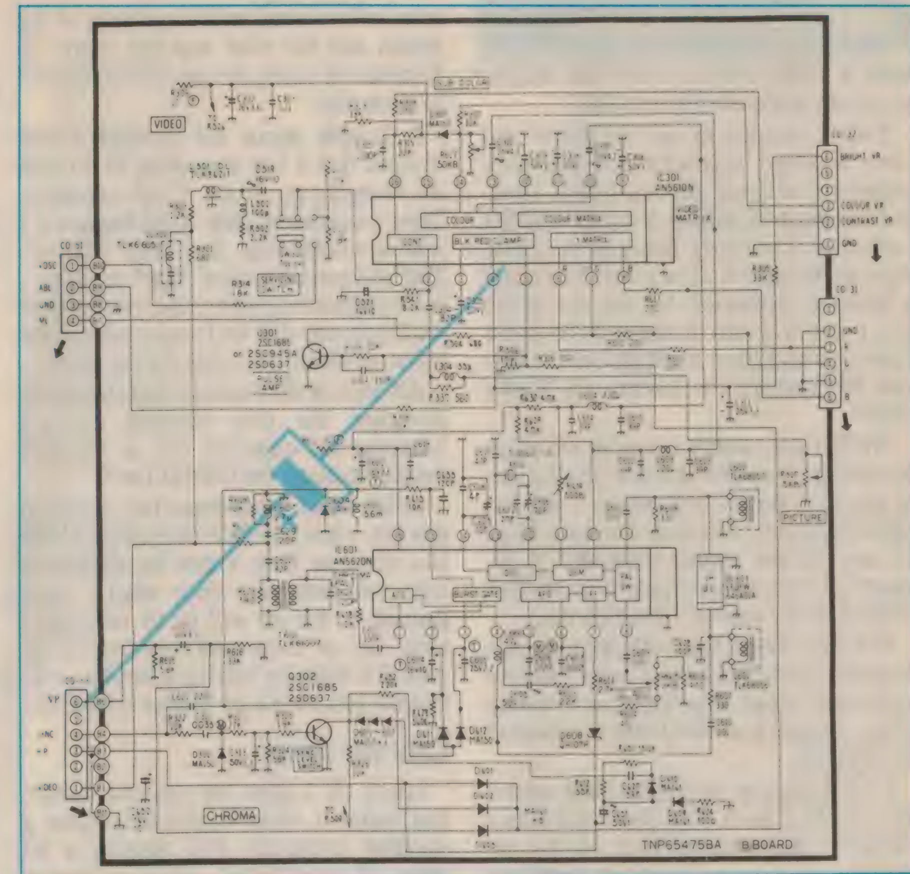
When I looked at the waveform at pin 5, the blanking input, I could see that the vertical pulse began with much enthusiasm — its amplitude was equal to that of the horizontal pulses. And if you remember, I had found this to be exactly as shown in the manual. But as the vertical period extended, the amplitude of the pulse fell away and when it ended, the amplitude was less than a quarter of its original level.

Now, thinking about the timing of this pulse, it's apparent that the start of the pulse represents the bottom of the screen, since that is where the spot begins vertical retrace. Therefore the end of the pulse must represent the top of the screen.

And since the lower amplitude at the end of the vertical pulse, and the top of the screen where the teletext lines are visible, both coincide, then this must be the basic reason for the trouble.

My task was to increase the amplitude at that vital last half of the vertical blanking pulse.

I looked with considerable disfavour at C625, that 3.3uF capacitor in the pulse line. Although I had checked its capacitance and found something like 3.7uF, I still wondered if it was really adequate to pass the pulse needed to maintain blanking. It was easy enough to dab another 3.3uF across the existing one. And when that made no difference, I



The schematic for the 'B' board of a National TC1807 CTV, which includes the video and chroma processing circuitry. Our Serviceman's own story this month involves one of these sets, on which Teletext lines were visible at top of screen.

used a 10uF, then a 22uF; but neither made any noticeable difference.

Then I decided to 'go for broke' and used a 470uF capacitor that just happened to be lying on the bench. However, instead of putting it across C625, I connected it directly between the pulse input at B6 and the IC at pin 5. This made a fantastic difference, but not one of the sort I would desire. It blanked the entire screen, except for a small area at the bottom left corner. The screen was totally black!

While I was staring aghast at the effect on screen, I noticed that the small piece of pic was slowly expanding. I left the cap in position, and over the next 30 to 45 seconds the picture expanded to almost full size, leaving only a small spot of black in the top right hand corner.

The most interesting point though, was that now the teletext lines were nowhere to be seen! Apart from the slow recovery of the picture, it seemed that I had cured the problem.

I fixed the cap in position and turned the set off. I let it cool down for a few minutes, then switched back on. By the time the tube had warmed up, the black area had retreated to the top third of the screen and the view was not nearly so dramatic as when the cap was connected to a hot tube.

I thought about the symptoms and realised that it had something to do with the charging up of the 470uF capacitor. Then I wondered what might happen if I used a smaller cap. So I tried a 220uF. This still caused a bit of 'black patching', but it recovered much more quickly than the bigger cap did. So I again reduced the value, to 100uF. And this did the trick.

All trace of the blackout had cleared by the time the tube warmed up, yet whatever the capacitor did, it was still enough to blank the teletext lines.

In all, I had spent about two hours on this job, when it should have taken a little less than one hour. I split the difference with the customer, since what I have learned on his set will be of value next time one of these problems comes in. And if it helps by solving a similar problem for you, then I am doubly rewarded.

Call for help

That's all I have for you this month. But before I close, a reminder about a standing invitation. I'm running a bit short of contributed servicing stories again, and with this recession making everyone think twice about getting their equipment repaired, my own workshop isn't generating as many stories (or as much cash!) as I'd like.

So if YOU have had an interesting servicing job recently, why not write down the basic story and send it in, so I can present it in this column for the edification of other readers? We can pay you a modest fee when it's used, to compensate you for your time.

Don't worry if you're not too experienced at writing. Just jot down the symptoms, what you tried, and what the problem eventually turned out to be caused by; I'll do the rest.

If possible, though, send me a good photocopy of the circuit schematic for the set concerned (or part thereof), just in case I don't have one. And if the problem turned out to be something mechanical, a clear photo or two might make things a lot easier to explain.

Of course if you can send in your story as an ASCII file on floppy disk, straight from your word processor, so much the better. We might well be able to pay you a fee that isn't *quite* so modest, because you'll be saving me from having to type it all in myself! ❖

History of Radar - 2

Continued from page 39

2.5us, to see whether the range could be improved. The MkIV was trialed at RAAF No.54RS radar station at Collaroy, a northern Sydney beach suburb. However, only two units were made before the project was cancelled in 1943.

By late 1944, the RAAF was concerned about the possibility of Japanese radar jamming. Some jamming of both radio and radar had occurred, and as all the ShD and AW variants operated on 200MHz, it was realised that it would be a simple matter to jam any of them. Various anti-jamming measures were introduced for existing sets, and RPL set out to design a frequency-agile radar called the LW/AW MkV, to incorporate all the anti-jamming modifications.

It would seem logical to simply alter the frequency of the standard LW/AW radars, but a phased antenna array such as had been used on all the radars up to this stage is very frequency sensitive — i.e., if the frequency is altered, the side lobe pattern changes dramatically. In fact it was determined that a change of no more than +/- 2MHz could be tolerated.

Consequently RPL came up with a new array that comprised a curved reflector of 25mm mesh, approximately 3m high by 6m wide, illuminated by a large tubular slotted radiator. This should have given a constant beam pattern over the range of 188-214MHz. However, as time went by RPL was unable to make this design perform and finally in May 1945 the RAAF, tired of the delay, fitted a standard LW/AW antenna and shipped two sets to No.324 Station in Borneo for trials. The anti-jamming modifications were of dubious effectiveness, and the RAAF decided to delete them all.

By this late stage, Japanese resources were so depleted that no real interference was suffered to any of our radars, and the war ended before the MkV design could be proved. However, the technicians at No.324 did find that when they pointed the antenna towards the office or workshops, they could excite long sparks from metal objects. This also excited the Commanding Officer, who was not amused. Fig.18 shows the MkV transmitter and modulator.

In the third and final article in this series, we'll look at the development of height-finding and GCI (ground-controlled interception) radars, and also consider what had been achieved overall by Australian radar researchers by the end of WW2.

(To be continued) ❖

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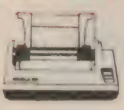

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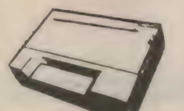

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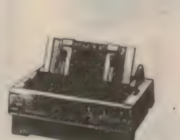

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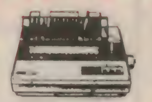

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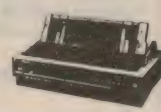

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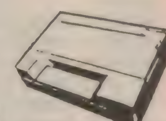

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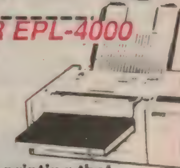

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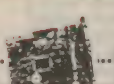

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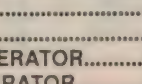

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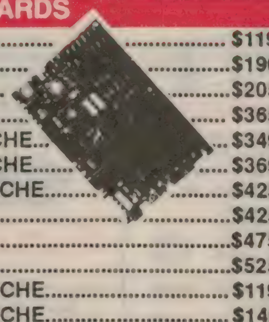

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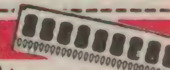

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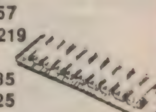

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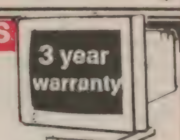

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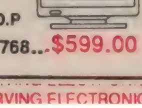

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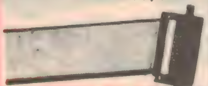

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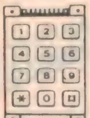

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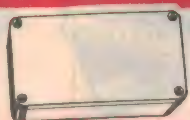

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Both are TO-82 plastic package.

PN100 REPLACES:
PN2221, PN2222, PN2222A, PN3585, PN3568, PN3569, PN3643, PN5133, 2N2219A, 2N2222A, 2N3414, 2N3415, 2N3416, 2N3417, 2N3700, 2N3704, 2N3904, 2N4123, 2N4124, 2N4401, 2N5088, 2N5210.

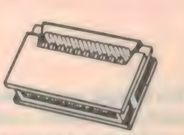
PN200 REPLACES:
PN2907, PN2907A, PN3638, PN3638A, PN3640, PN3644, PN4121, PN4143, PN4248, PN4249, PN4250, PN4355, PN4916, PN4917, PN5910, 2N2905A, 2N3467, 2N3702, 2N3906, 2N4125, 2N4126, 2N4291, 2N4402, 2N4403, 2N5086, 2N5087, 2N5447.
PN100......T90001
PN200......T90002

1-9	10+	100+
$0.20	$0.18	$0.15

SUPER BRIGHT LEDS

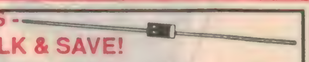
• RED..................Z10146
• GREEN...............Z10147
• YELLOW.........Z10148

1-9	10+
$1.00	$0.90



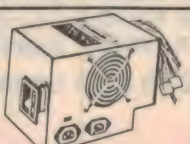
CARD EDGE CONNECTORS

.1" SPACING	1-9	10+
P12060 10pin	$3.95	$3.50
P12062 20pin	$4.25	$3.75
P12064 26pin	$4.50	$3.95
P12066 34pin	$4.95	$3.95
P12068 40pin	$5.95	$4.95
P12070 50pin	$6.95	$5.95



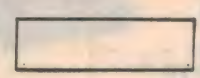
DIODES - BUY IN BULK & SAVE!

Cat No.		10+	100+	1000+	10K
Z10135	IN4148	$0.05	$0.04	$0.03	$0.02
Z10105	IN4002	$0.06	$0.05	$0.04	$0.03
Z10107	IN4004	$0.08	$0.06	$0.05	$0.04
Z10110	IN4007	$0.10	$0.07	$0.06	$0.05
Z10115	IN5404	$0.18	$0.14	$0.13	$0.11
Z10119	IN5408	$0.20	$0.16	$0.15	$0.14



POWER SUPPLIES

XT P.S 150W..........$139.00
FULL TOWER
220W P.S...............$149.00
MINI TOWER
200W P.S...............$89.00
BABY AT
P.S 200W...............$89.00
SLIMLINE BABY AT
P.S. 200W..............$89.00



BREAD BOARDS

This inexpensive range of modular interlocking units enables a quick easy way of experimenting with new circiuts and ideas. There are two main units consisting of a terminal strip or distribution and a central plug in unit.
• 100 holes.
P11000................$2.75
•840 + 100 holes
P11007..............$14.95
• 1280 +100 holes
• P11010............$26.95
•2560 + 700 holes
• P11018............$69.95

COMPUTER CABLES

• Six conductor shielded computer interface cable.
W12670 • CIC6 6 con.

1-9M	10M+	100M+
$1.30M	$1.10M	$1.00M

W12672 • CIC9 9 con.

1-9 M	10M+	100M+
$1.60M	$1.50M	$1.20M

W12674 • CIC12 12 con.

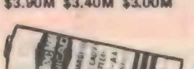
1-9M	10M+	100M+
$2.50M	$2.20M	$1.90M

W12676 • CIC16 16 con.

1-9M	10M+	100M+
$3.50M	$3.20M	$2.50M

W12678 • CIC25 25 con.

1-9M	10M+	100M+
$3.90M	$3.40M	$3.00M



NICADS

Save a fortune on expensive throw away batteries with these quality Nicads and Rechargers!

Size AA 450mAH

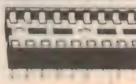
1-9	10+	100+
$2.95	$2.75	$2.50

Size C 1 2 A H

1-9	10+	100+
$9.95	$9.50	$8.95

Size D 1 2 A H

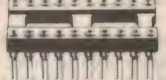
1-9	10+	100+
$9.95	$9.50	$8.95



LOW PROFILE IC SOCKETS

Save a small fortune on these "Direct Import" low profile IC sockets! PCB mounting solder tail. All tin plated phosphor bronze or berryllium and dual wipe for reliability.

	1-9	10+	100+
P10550 8 pin	15¢	12¢	10¢
P10560 14pin	20¢	18¢	15¢
P10565 16pin	20¢	18¢	16¢
P10567 18pin	30¢	25¢	22¢
P10568 20pin	35¢	30¢	25¢
P10569 22pin	35¢	30¢	26¢
P10570 24pin	35¢	30¢	26¢
P10572 28pin	45¢	35¢	30¢



WIRE wRAP IC SOCKETS

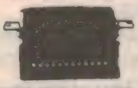
These quality 3 level wire wrap sockets are tin plated phosphor bronze.

	1-9	10+
P10579 8pin	$1.50	$1.40
P10580 14pin	$1.85	$1.70
P10585 16pin	$1.95	$1.80
P10587 18pin	$1.95	$1.80
P10590 20pin	$2.95	$2.75
P10592 22pin	$2.95	$2.70
P10594 24pin	$3.95	$3.50
P10596 28pin	$3.95	$3.50
P10598 40pin	$4.95	$4.50

WOW! WHAT PRICES!

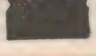
IDC PLUGS & SOCKETS

WOW ! FROM $1.00



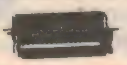
D TYPE IDC PLUGS

	1-9	10+	100+
• DE9P 9pin plug			
P12166	$1.50	$1.20	$1.00
• DA15P 15pin plug			
P12168	$1.50	$1.20	$1.00
• DB25P 25 pin plug			
P12170	$4.50	$3.95	$3.50



D TYPE IDC SOCKETS

	1-9	10+	100+
• DE9S 9 pin socket			
P12167	$1.50	$1.20	$1.00
• DA15S 15 pin socket			
P12169	$1.50	$1.20	$1.00
• DB25S 15 pin socket			
P12171	$4.50	$3.95	$3.50



IDC CENTRONICS 36 WAY PLUG & SOCKET

	1-9	10+	100+
• Plug P12200	$3.95	$3.00	$2.95
• Socket P12201			

ECONOMY TRANSFORMERS

	1-9	10+
2155 240V 6-15V 1A		
M12155	$8.95	$7.95
2156 240V 6-15V A2		
M12156	$13.95	$12.95
2851 240V 12-6V CT 250mA		
M12851	$4.95	$4.50
6672 240V 15 30vc 1A tapped		
M16672	$12.95	$11.95

12V DC FANS

80 x 80 x 25.4mm
12V DC. 1.7 Watt 0.14 Amp
T12469..................$18.95
10+ fans, only $17.95

FANS

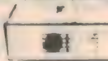
Quality fans for use in power amps, computer hotspot cooling etc. Anywhere you need plenty of air.
240V 4 5/8" T12461..$16.95
115V 4 5/8" T12463..$16.95
240V 3 1/2" T12465..$16.95
115V 3 1/2" T12467..$16.95

TOGGLE SWITCHES

	1-9	10+
S11010 S.P.D.T	$1.20	$1.10
S11020 D.P.D.T	$1.30	$1.20

ICB VOLTAGE REGULATORS BARGAINS

Description	1-9	10+	100+
7805UC	$0.50	$0.45	$0.40
7812UC	$0.50	$0.45	$0.40
7815UC	$0.50	$0.45	$0.40
7905UC	$0.60	$0.55	$0.50
7912UC	$0.60	$0.55	$0.50
7915UC	$0.60	$0.55	$0.50
78L05	$0.40	$0.30	$0.28
78L12	$0.40	$0.30	$0.28
LM324	$1.00	$0.90	$0.80
555	$0.40	$0.38	$0.33
741	$0.50	$0.45	$0.39

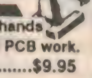


9 PIN D SWITCH BOXES

2 WAY...............$59.95
4 WAY...............$69.95
MONITOR & KEYBOARD SWITCH BOXES $69.50

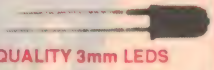
MINIATURE HOBBY VICE

• Lever operated suction base grip for instant mounting & portability.
• Mounts on smooth non-porous surfaces
• Ideal for holding & other small objects .
T12458................$6.95



PC BOARD HOLDER

Better than [illegible] of hands
A must for all PCB work.
T12444..............$9.95

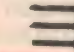


QUALITY 3mm LEDS

1000+	1-9	10-99	100+	1K
Z10140(R)	$0.15	$0.12	$0.10	$0.08
Z10141(G)..	$0.20	$0.18	$0.15	$0.12
Z10143(Y)..	$0.20	$0.18	$0.15	$0.12
Z10145(O)..	$0.20	$0.18	$0.15	$0.12

QUALITY 5mm LEDS

Z10150(R).	$0.15	$0.12	$0.10	$0.08
Z10151(G).	$0.25	$0.20	$0.18	$0.12
Z10152(Y)..	$0.25	$0.20	$0.18	$0.12

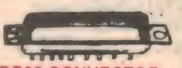


FLASHING LEDS

RED 5mm	1-9	10+	100+
Z10159	$1.10	$1.00	$0.80

RECTANGULAR LEDS

	1-9	10+	100+	1K
RED	20¢	15¢	12¢	10¢
GREEN	20¢	15¢	12¢	10¢
YELLOW	20¢	15¢	12¢	10¢



DB25 CONNECTOR SPECIALS

	1-9	10+	100+
P10880 DE9P	$1.00	$0.80	$0.60
P10885 DE9S	$1.00	$0.70	$0.60
P10891 DA15S	$1.00	$0.70	$0.60
P10892 DA15C	$1.00	$0.90	$0.60
P10895 DA15S	$1.00	$0.80	$0.60
P10902 DB25C	$1.00	$0.80	$0.60
P10904 DB25P	$1.00	$0.80	$0.60
P10905 DB25S	$1.00	$0.80	$0.60

MOSFET SPECIALS

	1-9	10+	100+
2SJ49	$9.50	$8.00	$7.00
2SJ56	$10.00	$9.50	$8.50
2SK134	$8.50	$8.00	$7.00
2SK176	$9.50	$8.90	$ 6.90
2SJ50	$9.50	$8.50	$7.00
2SK135	$9.50	$8.50	$7.00

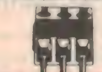
ELECTRET MIC INSERTS

With pins for easy board insertion. C10170

1-9	10-99	100+	1000+
$1.20	$1.00	$0.90	$0.70

TRANSISTORS BUY IN BULK & SAVE!

	1-9	10+	100+
BC 547	$0.15	$0.10	$0.07
BC 548	$0.15	$0.10	$0.07
BC 549	$0.15	$0.10	$0.07
BC 557	$0.15	$0.10	$0.07
BC 558	$0.15	$0.10	$0.07
BC 559	$0.15	$0.10	$0.07
BC 327	$0.20	$0.15	$0.12
BC 337	$0.20	$0.15	$0.12
BD 139	$0.75	$0.60	$0.50
BD 140	$0.75	$0.60	$0.50



PCB MOUNTING SCREW TERMINALS

(INTERLOCKING ENDS)
These terminals feature interlocking ends to form any number of connections. Standard 5mm spacing pins.

P10520 2way

1-9	10+	100+
$0.75	$0.70	$0.60

P10521 3 way

$1.00	$0.90	$0.80

IS YOUR SCHOOL PAYING TOO MUCH FOR IT'S COMPUTER SYSTEMS?

RITRON EXECUTIVE 386SX-31

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80386SX 25M CPU
2 MEG RAM EXP TO 8 MEG
31Mhz LANDMARK SPEED TEST
1.2M JAP F.D.D. 512K VGA CARD
40M HARD DISK DRIVE,
101 EXTENDED "CLICK" KEYBOARD
MINI CASE & 200W POWER SUPPLY
SUPA VGA COLOUR MONITOR 1024 x 768 Res 0.28" D.P
SERIAL PARALLEL GAMES PORTS
4 YEAR PARTS & LABOUR WARRANTY IBM* COMPATIBLE
SPREADSHEET, WORDPROCESSOR & DATABASE SOFTWARE INCLUDED.
* SHAREWARE SOFTWARE

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80386-33 CPU
64K CACHE ON BOARD MEMORY
2 MEG RAM EXP TO 16 MEG
57Mhz LANDMARK SPEED TEST
40 MEG HARD DISK
1.2M JAPANESE BRAND F.D.D
101 EXTENDED "CLICK" KEYBOARD
SERIAL PARALLEL GAMES PORT
MINI CASE & 200W POWER SUPPLY
SUPA VGA COLOUR MONITOR (1024 x 768 Res) 0.28" DP
512K VGA CARD (256 COLOURS) IBM* COMPATIBLE
4 YEAR PARTS & LABOUR WARRANTY
SPEADSHEET, WORDPROCESSOR & DATABASE SOFTWARE INCLUDED.
*SHAREWARE SOFTWARE

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ADD PRICE TO BASE SYSTEM COST.

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MS DOS 5.0 ADD $99.00
MS DOS 5.0 & WINDOW 3.1....$179.00
1M VGA CARD $100.00

TO CHANGE A 40M HARD DRIVE TO A

85M HD add $100
126M HD add $210 105M HD..$175
200m HD add $450 170M HD..$275

EXTRA RAM

1M add $59 2M add $118 4M add $236

SOUND CARDS

SOUND COMMANDER FX.........................$159
SOUNDBLASTER V2 With Speakers.........$149
SOUNDBLASTER PRO.............................$299
FLOPTICAL DRIVE add..........................$649
21 M/BYTE DISC TO SUIT........................ $49
CD ROM SOUND BLASTER PACK............ $949
PARRADISE WINDOW ACCELERATOR.....$275
CASES MINI TOWER.$50 FULL TOWER.$200

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80386-40 CPU 64K CACHE ON BOARD
4 MEG RAM EXP TO 16 MEG
65 Mhz LANDMARK SPEED TEST
40 MEG HARD DISK 12ms ACCESS TIME. 1.2M JAPANESE BRAND F.D.D
101 EXTENDED "CLICK" KEYBOARD
MINI CASE & 200W POWER SUPPLY SERIAL, PARALLEL, GAMES PORTS 512K VGA CARD, SUPA VGA COLOUR MONITOR
(1024 x 768 Res) 0.28" 4 YEAR PARTS & LABOUR WARRANTY SPEADSHEET, WORDPROCESSOR & DATABASE SOFTWARE INCLUDED. *SHAREWARE SOFTWARE

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80486SX-25 CPU
4 MEG RAM EXP TO 32 MEG
75Mhz LANDMARK SPEED TEST
40 MEG HARD DISK
1.2M JAPANESE BRAND F.D.D
101 EXTENDED "CLICK" KEYBOARD
MINI CASE & 200W POWER SUPPLY
4 YEAR PARTS & LABOUR WARRANTY
SERIAL, PARALLEL, GAMES PORTS, 512K VGA CARD
SUPA VGA COLOUR MONITOR (1024 x 768 Res) 0.28" DP
SPEADSHEET, WORDPROCESSOR & DATABASE SOFTWARE INCLUDED. *SHAREWARE SOFTWARE

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80486-33 CPU
256K ON BOARD CACHE. 4 MEG OF RAM
157Mhz LANDMARK SPEED TEST
40 MEG HARD DISK
1.2M JAPANESE BRAND F.D.D
101 EXTENDED "CLICK" KEYBOARD
SERIAL, PARALLEL, GAMES PORTS
512K VGA CARD. IBM* COMPATIBLE
SVGA COLOUR MONITOR (1024 x 768 Resolution) 0.28"DP
MINI CASE & 200W POWER SUPPLY
4 YEAR PARTS & LABOUR WARRANTY
SPREADSHEET, WORDPROCESSOR & DATABASE SOFTWARE.

NOW WITH 4 MEG OF RAM!

$2,249 TAX INC. — WITH 200 MEG DRIVE **$2,699** TAX INC

$1,870 TAX EX. — **$2,245** TAX EX

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80486-33 CPU 256K ON BOARD CACHE. 4 MEG OF RAM
157Mhz LANDMARK SPEED TEST
200 MEG HARD DISK 5ms T.T ACCESS TIME. 1.2M JAPANESE BRAND F.D.D
3.5" 1.44M JAPANESE BRAND F.D.D
101 EXTENDED "CLICK" KEYBOARD
SERIAL, PARALLEL, GAMES PORTS
1 MEG VGA CARD. IBM* COMPATIBLE
TOWER CASE & 220W POWER SUPPLY
SUPA VGA COLOUR MONITOR (1024 x 768 Res) 0.28" DP
4 YEAR PARTS & LABOUR WARRANTY
SPEADSHEET, WORDPROCESSOR & DATABASE SOFTWARE.

200M HARD DRIVE & TOWER

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IDEAL CAD MACHINE! **$2,579** TAX INC.

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80486-50 CPU 256K ON BOARD CACHE. 4 MEG OF RAM
200+Mhz LANDMARK SPEED TEST
200 MEG HARD DISK 5ms T.T ACCESS TIME. 1.2M JAPANESE BRAND F.D.D
3.5" 1.44M JAPANESE BRAND F.D.D
101 EXTENDED "CLICK" KEYBOARD
SERIAL, PARALLEL, GAMES PORTS
1 MEG VGA CARD. IBM* COMPATIBLE
TOWER CASE & 220W POWER SUPPLY
SUPA VGA COLOUR MONITOR (1024 x 768 Res) 0.28" DP
4 YEAR PARTS & LABOUR WARRANTY
SPEADSHEET, WORDPROCESSOR & DATABASE SOFTWARE.

200M HARD DRIVE & TOWER CASE

ASSEMBLED & TESTED IN AUSTRALIA.

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Add $300 for DX66

RITRON EXECUTIVE 486-EISA

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80486-EISA CPU 256K ON BOARD CACHE. 4 MEG OF RAM
167 Mhz LANDMARK SPEED TEST
200 MEG HARD DISK 12ms ACCESS TIME 1.2M JAPANESE BRAND F.D.D
3.5" 1.44M JAPANESE BRAND F.D.D
101 EXTENDED "CLICK" KEYBOARD
SERIAL, PARALLEL, GAMES PORTS
1 MEG VGA CARD. IBM* COMPATIBLE
TOWER CASE & 220W POWER SUPPLY
SUPA VGA COLOUR MONITOR (1024 x 768 Res) 0.28" DP
4 YEAR PARTS & LABOUR WARRANTY
SPEADSHEET, WORDPROCESSOR & DATABASE SOFTWARE.

200M HARD DRIVE & TOWER CASE

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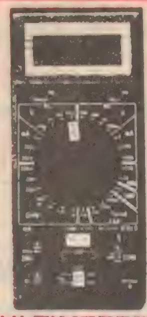

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WOW 20 AMP CURRENT RANGE

DIGITAL MULTIMETER HC-3500T

The HC-3500T is completely portable, pocket sized 3 1/2 digit multimeter designed for use by the engineer, technician, and hobbiest who demand an instrument, that is accurate, reliable and always ready for use. Equipped with nine functions and 28 ranges, each test position is quickly and easily selected with a simple turn of the single selector switch. Small enough to fit in attach cases and equipped with a multi-position tilt stand. The instrument is equally suited for design engineering, production testing, field servicing and industrial maintenance applications.

- Display: 3 1/2 digit
- Basic Accuracy 0.5% DC
- DC Voltage: 0-100V
- DC Current: 0-20A
- AC Voltage: 0-20A
- Resistance: 0-20M ohms
- Temperature: -20°C - 1200°C
- Continuity test, Diode test, Temperature, Capacitance, Frequency, hfe Test, Data hold.

Q13000......................$149.00

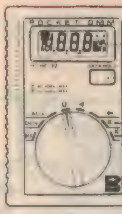
NEW In 1993

ROTARY TYPE AUTORANGE BAR-GRAPH DMM HC-889

- Safety compiled design
- The smallest compact hand held autoranging BAR-GRAPH DMM
- Automatically range and function annunciation on LCD.
- Hold / Memory mode for realitive measurements.
- Extended 20M ohm range, hFE diode checker
çcontinuity detection with 4KHz audio drive signal
- Low battery detection & display warning annunciator.
- Convenient 9V battery operation
- Full scale of 40 pcs Bar display.

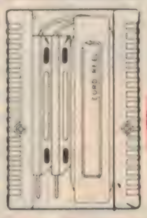
DISPLAY: 3 1/2 DIGIT
DC VOLTAGE: 0-1000V
DC CURRENT: 0-10A
AC VOLTAGE: 0-750V
RESISTANCE: 0-20M OHMS
CONTINUITY TEST, DIODE TEST, DATA HOLD, TR HFE GAIN, AUTO RANGE DMM WITH BAR GRAPH

Q13040........................$89.95



Front

Small & light for your top pocket.



Back

NEW In 1993

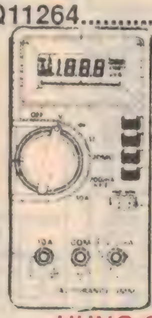
HUNG CHANG POCKET PERSONAL DIGITAL MULTIMETER Model HC-32

- Custom designed 80-pin LSI chip to achieve a low overall component count, ensuring long term stability and accuracy.
- New LCD display with anniniators for functions, unit, polarity, decimal point and low battery indicator.
- Rotary pocket type.
- Auto ranging polarity.
- Overranging indication on all ranges
- Measurement ranges (DCV, ACV, Resistance & Continuity Check, Diode Check 200mA DC/AC)
- Data hold switch to fix the reading.

SPECIFICATIONS:

- Operation System: Integration
- Display: 3 1/2 digit LCD
- Range Selection: Full autoranging system
- Sampling Time: 0.5 seconds
- Power requirement: 1.5V (A.A.A) x 2 battery
- Operating environment: 0°C~40°C
- Dimensions: 10cm (h) x 7cm(w) x 1.5cm (d).

Q11264...................$49.00



NEW In 1993

HUNG CHANG MULTI-TESTER DM301

- 3 1/2 Digit, Basic Accuracy DMM
- Low Cost, Amazing Quality, Vane pocket size.
- Safety Designed-Compiled to UL1244, VDE 0411
- Overload protection
- Diode Check

SPECIFICATIONS:
Display: 3 1/2 digit LCD. 0.5 height, with polarity.
Overrange Indication; 3 least significant digits blanked.
Maximum Common mode Voltage: 500V peak
Operating environment: 0 to 50°C
Power: 9V alkaline or carbon zinc cells
Dimensions: 128mm x 75 x 24mm

Q13050..................$49.95

NEW In 1993

HUNG CHANG DIGITAL MULTIMETER HC-31

- Custom designed 80-pin LSI chip to achieve a low overall component count, ensuring long term stability and accuracy.
- New LCD display with annunciators for functions, unit polarity, decimal and low battery.
- Rotary pencil type
- Auto ranging and auto polarity.
- Convenient one hand operation by connecting the alligator clip.
- Measurement ranges (DCV, ACV, Resistance and Continuity Check, Diode Check).
- Data hold switch to fix the reading.

SPECIFICATIONS:
Operation system: Integration

- Display: 3 1/2 digit LCD
- Range Selection: Full auto ranging system
- Sampling Time: 0.5 seconds
- Power requirement: 1.5V (A.A.A) x 2 batteries
- Operating Environment: 0° ~ 40°C
- Dimensions: 170mm x 35mm x 21mm.

Included with the HC-31:

- 1 Alligator crp
- Long Pin tip
- Carrying Case
- 2 A.A.A batteries
- Instruction manual

Q11270....................$49.00

TRIED AND TESTED

ANALOGUE WORKHORSE

- Fuse and Diode protection
- hFE measurements 0 - 1000 (By x 10 range)
- Mirror scale for more accurate reading.

RANGES

- DC Voltage: 0 - .1, 0.5, 2.5, 10, 50, 250, 1000V. (20k ohm/v)
- AC Voltage: 0 - 10, 50. 250, 500V, 1000V (8kohm/V)
DC Current: 0-0.05, (50uA) 2.5, 25, 250mA
- Resistance: 0-2K, 20K, 2M 20M ohm
- Load Current: 0-150uA, 15mA, 150mA
- Load Voltage:0-3V
- Volume Level: -10- + 22dB - + - 62dB
- DC Current Amplification Factor: (hFE) 0-1000

Every Tool box should have one

ACCURACY

- DC Voltage & Current: Within +/-3% f.s
- Resistance: Within =/-3% 0f arc.
- Battery: 1.5V (um-3) 2pcs. 9V (oo6p) 1 pc
- Fuse: o.5A, 5O x 20mm
- Diode: 4148 x 2
- C.C: 0.04uff x 50V
- Size: 147 x 99 x 57mm
- Weight: 400g approximately

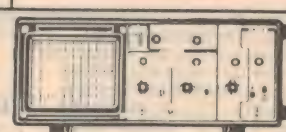
Q11020......................$59.95

GET THE BEST OF BOTH WORLDS WITH THIS ANALOGUE DIGITAL MULTIMETER

ANALOGUE / DIGITAL MULTIMETER

- HC - 505DB 3 1/2 DIGIT
- Basic accuracy: 0.5%DC
- DC Voltage: 0 - 1000V
- DC Current: 0-10A
- AC Voltage: 0 -750V
- AC Current: 0 - 10A
- Resistance: 0 - 20M ohms
- DC AC DMS:-45dB - +50dB
- Temperature: -20°C -1200°C
- AC Freq Spread: 50 Hz - 2KHz Continuity Test, Diode Test.

Q13020............$169.00



20 MHz DUAL TRACE OSCILLOSCOPE

CTR DISPLAY: • 150 mm rectangular

VERTIACAL DEFLECTION:

- Deflection Factor: 5mV to 20V / Div on 12 ranges in 1-2-5 step with fine control
- Bandwidth DC: DC to 20 MHz (-3dB)   AC: 10Hz to 20 MHz (-3dB)
- Operating modes CH-A, CH-B, DUAL and ADD (ALT/CHOP L202 only)
- Chop Frequency: 200 KHz Approx.
- Channel separation: Better than 60dB at 1KHz

TIME BASE

- Type: Automatic & normal triggered in automatic mode, sweep is obtained without input signal
- Sweep Time: 0.2m Sec to 0.5 Sec/ Div on ranges in 1-2-5 step with fine control and X-Y.
- Magnifier: X5 at all times.

TRIGGERING

- Sensitivity Int: 1 Div or more   Ext: 1Vp-p or more.
- Source: INT, CH-B, LINE or EXT
- Triggering Level: Positive and Negetive, continuously variable level; Pull for Auto.
- Sync: AC, HF Rej, TV (each + or-) at TV Sync. TV-H (line) and (frame)

sync are switched automatically by SWEEP TIME/Div switch.

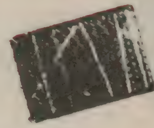
HORIZONTAL DEFLECTION

- Deflection factor: 5mV to 20V/ Div on 12 ranges in 1-2-5 step with fine control
- Frequency response: DC to MHz (-3dB)
- Max Input Voltage: 300V DC + AC Peak of 600V p-p
- X-Y operation: X-Y mode is selected by SWEEP TIME/ Div switch.
- Intensity Modulation Z Axis: TTL Level (3Vp-p~50V) + bright, - dark

OTHER SPECS: • Weight: 7Kg Approx • Dimensions: 162 (H) x 294(W) x 352(D)mm.

Q12105.. $619.00 SPECIAL TAX EX SCHOOL PRICE $519.

SCHOOLS BACK! These solar kits make great school projects.

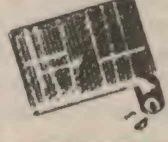


ENCAPSULATED SOLAR CELL MODULE

0.45V 200mA

These are ideal for simple solar experimemts. Can be connected with other solar cells.

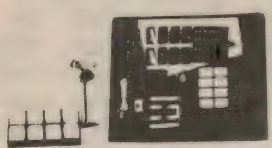
Z19001........................$2.95



SOLAR MOTOR KIT

This is a great starter kit consisting of a 0.9V 400mA solar cell and a small motor with a 48" wire. Great for beginner or just the curious!

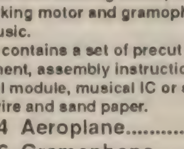
Z19040........................$9.95



EDUCATIONAL SOLAR ENERGY KIT.

Learn what solar power is and how to build your own solar system. With this great kit you can make an electrical circuit. Learn how to increase voltage, learn how to increase current, learn how to make a solar panel, use solar power to produce the energy for a radio, calculator battery charger or 1.5V cassette player

Z19042...................$22.95



SOLAR WOODEN MODELS

Build great little solar powered wooden models with these kits! There are 3 different models to choose from a helicopter with working motor, aeroplane with working motor and gramophone that plays music.

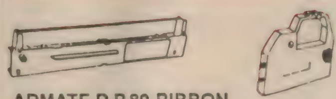
Each kit contains a set of precut plywood, PVA cement, assembly instruction sheet, solar cell module, musical IC or small DC motor, wire and sand paper.

Z19044 Aeroplane...........$19.95

Z19046 Gramophone......$19.95

Z19048 Helicopter...........$19.95

OUR LATEST RANGE OF PRINTER RIBBONS



ADMATE D.P.80 RIBBON
C21238..................................$18.95

BROTHER AX10/40 RIBBON
C21240..................................$18.95

BROTHER CE/EM RIBBON
C21242..................................$18.95

BURROUGHS B.300
C21244..................................$24.95

CANON AP100/150 RIBBON
C21246..................................$18.95

CANON AP11. 200/400
C21248..................................$18.95

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C21250..................................$18.95

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C21256..................................$18.95

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C21258..................................$22.95

PRINTRONICS P300, 600 SPOOL
C21260..................................$29.95

NEW COMPUTER PRODUCTS

KEYBOARD WRIST REST

This is the product that all secretaries, word processing operators, or .keyboard operators have been waiting for! The Wrist Rest lays in front of the keyboard and allowsyou to keep your hands at the correct height while preventing fatigue.

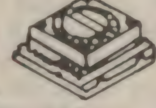
C21093............................$9.95

SOUND BLASTER CD ROM CADDY

The more CD's are out of their protective covers the more risk there is of damage through dust and scratches. Avoid damaging your CD ROMS by always storing them in these caddies that slide straight into your CD ROM.

X25030..................................$19.95

COOLING CAP



If your 486 Supa Hot you might need a fan " COOLING CAP"
Comes complete with heatsink fan.
5 Volt adaptor.
Installation instructionsare on the box.

H10611..........................$39.95

SOUND BLASTER CARDS

SOUND BLASTER 2

The sound blaster II is the ultimate sound board that easily plugs into any slot in your IBM, PC, XT, AT, 386, etc.

TEXT- TO SPEECH SYNTHESIZER
- 11 VOICE FM MUSIC SYNTHESIZER
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- DIGITIZED VOICE INPUT (8 BIT ANALOGUE TO DIGITAL CONVERSION)
- BUILT-IN MIDI INTERFACE FOR CONNECTING MUSICAL INSTRUMENT.
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- BUILT-IN STEREO POWER AMPLIFIER
- BUILT-IN STEREO POWER AMPLIFIER

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FM INTELLIGENT ORGAN - CREATES ORCHESTRA LIKE MUSIC USING YOUR PC KEYBOARD AS INPUT.
JUKEBOX - A WINDOWS THREE APPLICATIONS.

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5 1/4" With speakers $149.00

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3 1/2" Without Speakers...$127.50

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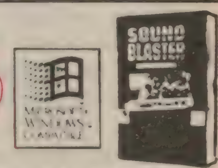
SOUND BLASTER PRO

plus WINDOWS 3.1 Drivers



MORE THAN JUST - LISTENING EXPERIENCE!
THE SOUND BLASTER PRO CARD EASILY INSTALLS INTO YOUR IBM PC/AT AND 100% COMPATIBLES.
(286 AND HIGHER RECOMMENDED)

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- RCA AUDIO CABLE
- 5.23" AND 3.5" DISKETTES
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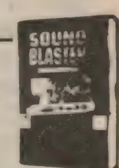
- SBTALKER (TEXT-TO-SPEECH SOFTWARE)
- FM INTELLIGENT ORGAN SOFTWARE
- CD MUSIC PLAYER
- MMPLAY PRESENTER
- DOS DRIVERS AND WINDOWS DLL
- SB MIDI - A MIDI FILE DRIVER
- SBSIM - A SB STANDARD PROGRAMMING TOOL

SYSTEM REQUIREMENT
- IBM PC/AT OR 100% 286 AND HIGHER COMPATIBLES (286 AND HIGHER RECOMMENDED)
- MINIMUM 512KB RAM
- DOS 3.0 OR HIGHER
- EGA OR VGA (VGA RECOMMENDED)

X18021.....$299.00

SOUND BLASTER PRO V2

SP PRO MIDI SEQUENCER SOFTWARE



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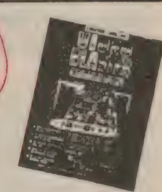
- MINIMUM 512KB RAM
- DOS 3.0 OR HIGHER
- EGA OR VGA (VGA RECOMMENDED)

X17050........$399.00

VIDEO BLASTER

VIDEO CAPTURE
COLOUR CONTROL
TEXT OVERLAY
SPECIAL EFFECTS



YOU AIN'T SEEN NOTHIN' YET!

The Video Blaster is the next logical step in multimedia. Just imagine being able to integrate video and audio source from laser disc, VCR, or camera, and combine VGA graphics into a brand new psychedelic world of multimedia presentations.
Video blaster supports lifelike colours on your standard VGA monitor. The characteristics of Red, Green & Blue - brightness, contrast, hue - can be controlled: stereo audio volume can also be individually mixed via the software.
With Video Blaster, video images can be digitized and captured through the Video Blaster for use with other programs for storage, presentation, and even animation!
Experience the thrills and ease of graphics overlayed with video sources through the Video Blaster.
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Moffat's Madhouse...

by TOM MOFFAT

Singing the praises of duct tape, in whatever colour

Last winter a truly crazy show was running on SBS television, which most of you probably would have missed. With the simple title of *The Red Green Show*, its newspaper listing wouldn't make you jump up and flip the dial. But here in Hobart we don't have a real big choice in television viewing, so most of us are willing to try anything — once.

It's hard to describe something like *The Red Green Show*, other than to say it's certainly not some obscure comedian standing there babbling at the camera for half an hour. *The Red Green Show* is made in Canada, and it's set in a men-only huntin', fishing' and shootin' lodge on Possum Lake in the back woods. There are not the twittering birds and chirping crickets you'd expect; instead all background sound is filled in by a roaring chain saw.

The compere Red Green stands in front of the camera, dressed in the compulsory red-and-white checked bush shirt, fishin' pants, and a floppy little hat with fish hooks in it. He delivers his lines in the same droll, flat manner as the well-known Fred Dagg from New Zealand. Red Green is a bit weird, but he is a tower of normality compared with the other men who populate 'the lodge'. The whole lot of them are bonkers — every single one.

Worst of all is Red Green's nephew Harold, who is the 'producer' of the show, mostly because he's related to Red Green. Harold is always pictured wearing around his neck a control panel from a 20-year-old Ampex studio videotape machine. Below it hangs what appears to be a defunct Commodore 64 computer, and at one end of the control panel proudly sits a pair of rabbit ears, through which Harold sends his commands to direct the show. Harold himself is the world's original nerd. He's obviously been worked over by makeup; nobody real could look (and act) that awful.

From time to time the lodge holds a meeting, which is heralded by the enraged screeching of a possum, off-camera. Upon entering the lodge we first see this box with what is obviously the rear end of a possum sticking out of it. A fellow is grinding a crank on the side of the box and it's obvious where the screeching is coming from. Over the top, but very funny.

Within the meeting we meet the paranoid policeman, the town doctor who is a liar and a thief, the holidaying theatre producer who is a bit 'that way', the giant macho-man who only speaks abuse, and the council officer who spends every working day playing golf. All these people are served up as comedy characters, and believe it or not, it works.

A weekly segment in *The Red Green Show* is 'Handyman Corner'. Here the master himself shows us do-it-yourself projects, such as how to install a home air conditioner in a car (requiring removal of only one door), how to install a sun-roof in your car using only one tool, an axe; and how to turn an old hot-water cylinder into a mini-submarine.

And throughout all these projects runs one common thread: duct tape. Every device, every car, every house at Possum Lake is held together with duct tape. Fishing rods are fixed with duct tape, boats don't sink because of duct tape; the security alarm on the paranoid policeman's home is fastened to the wall, right next to the front door, with duct tape.

Duct tape is the only part of *The Red Green Show* that makes the slightest bit of sense. Like everything else it is exaggerated, but not as much as you'd think. Because sitting right here on the kitchen table in front of me is a big roll of duct tape. I've just finished using it in yet another temporary satellite antenna installation. Duct tape holds the upper wiring to the mast, duct tape holds the balun in place, duct tape lashes the coaxial cable to the mast as it makes its way down.

For those who haven't yet sampled the joys of duct tape, an explanation: what we're talking about is cloth-based tape about 50mm wide, which is almost always silver in colour. It's primary use is in sealing together lengths of heating ducts. But the stuff is so useful for other things that it's now a situation of 'every home should have one'. So should every workshop. The stuff is amazingly strong, waterproof, and long lasting. So your 'temporary' duct-tape project from 10 years ago can still be in use today. Just look at my own TV antenna installation.

A similar product is known in the theatrical and music industries as 'gaffer tape'. This is duct tape in colours, such as red, green, yellow, white, and black. Gaffer tape is used to stick microphones to stands when a proper adapter isn't available; it's used to stick microphone cables down to the floor so people don't trip over them; it's used to hold lights and reflectors in place for filming. And when the job's finished, you can pull the gaffer tape away and everything is back to normal.

My electronic training was firmly based on duct tape, although I guess more correctly it should be called gaffer tape, because it was yellow. Always yellow. So, throughout the entire American space program, throughout the whole military/industrial complex, the stuff was known as (wait for it...) Yellow Tape! It's pronounced all as one word — 'Yellowtape' — with the emphasis on *Yellow*.

You would have thought during the earliest missile tests all the doo-dads and thingamejiggers would have been fastened together with the very best stainless steel hex-head machine screws. Nope — yellow tape. At one stage I had an installation job to do at Los Alamos, in the building housing the nuclear reactor that preceded the very first atomic bomb. The reactor was covered with instrumentation, which was held in place by very elderly strips of yellow tape.

At this time, back in the 1960's, that reactor would have been 25 years old or so, but it was still in daily use for all kinds of radiation experiments. There

was more modern instrumentation everywhere — all held together with fresher yellow tape.

A few years later I was working on one of the 'test ranges' run by Sandia Laboratories, known nowadays for their research into things like solar and wind power systems. These are built up full-size in desert locations, and are no doubt held together with yellow tape.

Being in the desert, these test ranges were subject to furious sandstorms which could blow clouds of dust right through the cracks in the frames of fully-closed windows. But that was no problem; just before the windy season, we always sealed the gaps of every window of every house with — you guessed it, yellow tape. We went through masses of it.

Leftover ends of rolls never went back to 'the company'; they were always kept for household repairs. Many ancient cars had their nice black seats patched up with yellow tape. I once had a leather camera case in which all the stitching rotted, so I stuck it back together with yellow tape. Every now and then I'd run into a stranger who would say 'Do you work for Sandia?' Even clear over on the other side of the continent, they'd recognise the yellow tape.

When I was working at that test range, long before the days of solar and wind power experiments, scientists spent a lot of time studying the many effects of explosives. Some of this was military-related, I suppose, but other projects were aimed at things like digging a new Panama Canal without blowing the nearby residents to smithereens.

In the trench-digging experiments, we used very delicate air-pressure sensors to measure the effect of blast from explosions. Before a test, each of 15 sensors was cleaned, calibrated, and then sealed with yellow tape.

In the final minutes before the explosion was let off, I used a jeep to run around to the 15 pressure sensors, removing the yellow tape from their air inlet holes. Unless I arrived back with 15 little squares of yellow tape, the test did not go ahead.

Digging trenches was pretty mundane stuff compared to some of the pure research being carried out. One project determined what would happen if you shot an object at high speed into a concrete block. These experiments took a matter of microseconds from start to finish, and everything had to be recorded on film or by strain gauges.

There was a small, carefully set out area through which an object would be fired, just before the block of concrete. High-speed cameras were installed on scaffolding (with yellow tape, of course) looking straight down onto the area, as well as in from one side. Opposite the cameras were sheets of plywood painted white with a black grid.

Knowing the distance between the lines of the grids, and having them available in two dimensions, we could place the object exactly at a point in space at a given time. By measuring two adjacent film frames, and knowing the film speed, we could work out exactly how fast the object was travelling when it hit the concrete. It's just like the stuff you see in television commercials, where they smash 'safe' cars into concrete walls to show the dummy occupants being protected.

Our tests were really missile tests in miniature, with the object of achieving the highest possible speed before impact with the concrete. The test unit, which was usually a stainless steel model of a rocket, was enclosed within a cylinder of balsa wood called a 'sabot'. The sabot was made in two or three closely fitted pieces so that it could fly apart easily, hopefully to disintegrate, leaving the little rocket to fly on its own. The cylinder was held together with one wrap of yellow tape.

The sabot, with enclosed missile, was shoved down the muzzle of an army artillery 105mm field Howitzer. But instead of using a ready-made shell, this particular cannon was arranged to take separate bags of high explosive piled onto the breech. When the big moment came, the cameras were rolled for a second or two to get them up to speed, and then the cannon was fired electrically. When the sabot emerged from the muzzle, the yellow tape split and the light balsa wood flew apart and then simply disappeared, leaving the missile hurling toward the concrete block.

As I said before, speed was everything, and the experimenters were encouraged to put more and more bags of explosive into the breech of the cannon. In the early experiments the cannon just went 'boom', like a good cannon should. But as more and more explosive was poured in, it began to kick violently, and eventually the entire Howitzer would rise from the ground and fly backward several metres before coming down again, sometimes on its side.

The range safety officer had ordered that these tests were to be conducted by remote control, from a long way away. This was fortunate, because one day saw the straw that broke the camel's back. It was decided to add just a couple more bags of explosive, to squeeze a tiny bit more muzzle velocity out of the cannon.

When the explosion went off, the Howitzer bucked as it had never bucked before — as the sides split out of the breech. Then the whole cannon just blew to bits, slinging shrapnel everywhere. The scaffolding holding the cameras seemed to spin into low orbit, coming down in a twisted heap. As for the cameras, they were a write-off. But it wasn't hard to find them; they were still firmly attached to the twisted scaffolding... by yellow tape.

Before the whole site was blown to oblivion, the cameras managed to record several hundred frames of picture, at around 18,000 frames a second. They clearly showed the little missile boring into the concrete block and emerging INTACT from the other side, leaving a clean hole. It was as if the block were made of butter, not concrete, over a metre thick — fantastic!

This is exactly what the theorists had predicted would happen, but one never knows these things for sure unless one tries them... that's what test ranges are for.

Was it worth blowing a whole test facility to kingdom come to find out? I guess so, because a few days later the site was being rebuilt again, with the help of great lashings of yellow tape. ❖

SHORTWAVE LISTENING

by Arthur Cushen, MBE

Seventy years of broadcasting celebrated

This month we move to mediumwave to report a historic event — the 70th anniversary of the world's oldest radio station outside of North America. Operated by the Otago Radio Association, it commenced broadcasting from Dunedin, New Zealand, on October 4, 1922. This historic event has been recognised by New Zealand Post with the issue of a special 50 cent stamp.

Looking back, we find that in North America broadcasting was established by pioneers such as Marconi in Montreal, Canada, commencing operation in September 1919; while in Pittsburg, USA, KDKA opened its broadcasting on November 2, 1920.

In the South Pacific, the Otago Radio Association's operation was the first, followed in 1923 by several Australian stations. These include 2FC in Sydney — now using the call 2RN — and in South Australia, 5DN with experimental broadcasts in June 1924, and the official opening of 5CL in November 1924.

Public interest in broadcasting was initially generated in Dunedin by experiments carried out at Otago University by Dr Robert Jack, Professor of Physics in 1921. In that year, Dr Jack made the first radio telephony broadcast ever heard in Dunedin, with a transmission of speech and music.

This created great interest, and during 1922 meetings of wireless enthusiasts were held which resulted in the Otago Radio Association being formed, on August 1. A temporary transmitter was acquired by the Association, and a licence to transmit on a wavelength of 300 metres at 50 watts was granted by the Post and Telegraph Department. Regular broadcasting started on October 4 on Tuesday and Friday evenings.

Finance was difficult to obtain, but due to some generous offers of equipment and studio facilities, broadcasts were able to continue. In October 1926 the call sign 4ZB was allocated, while in 1930 a new home was found for 4ZB in Rattray Street, which was to be the station's home for 40 years. In 1937, when the first commercial station in Dunedin opened under state operation, it claimed the call sign 4ZB, in common with calls in Auckland, Wellington and Christchurch. This meant that a new call sign was changed to its present call 4XD in 1948, when non-commercial stations were given the 'X' call sign — today that call denotes private radio stations. For most of its history, 4XD has been operated by volunteers.

When the government purchased all broadcasters in 1936, the Dunedin station was exempted because it was a hobby station, and so was allowed to continue.

Recently, deregulation in New Zealand has allowed 4XD to become a full time commercial operation, broadcasting 24 hours a day on 1305kHz with 2.5kW. It

Top Left: Brian Marston in the modern studios of 4XD, which were opened on 18th November, 1991.

Top Right: NZ Post celebrated 70 years of broadcasting in New Zealand with the issue of this special 50 cent stamp.

Far Right: D. G. Mitchell, a founding member of the Otago Radio Association in 1922 who was the station engineer right up to his death in 1970. He is photographed in a small portion of the 78's Library and the old Black Box.

AROUND THE WORLD

FRANCE: RFI Paris is broadcasting three daily transmissions in English: 1230 - 1300 to the Far East and Europe on 9805, 11,670 and 15,425kHz; 1400 - 1500 to Asia on 11,910, 15,405 and 17,695kHz; 1600 - 1700 to Africa on 11,705, 17,620 and 17,850kHz. French to Australia is scheduled 1030 - 1130 on 15,285kHz, with the transmission coming from China. The schedule shows eight relay bases and 54 frequencies are in use. Relay bases are in China, Cyprus, France (2), Gabon, Guiana, Hungary and Japan.

GUAM: KSDA has retimed its English broadcasts and is now heard daily at 0100 and 2300 on 15,610kHz; and at 1600 on 11,980kHz. On Saturday - Sunday, transmission at 0200, 1700 and 1800 is on 13,720kHz.

NEW ZEALAND: Radio New Zealand International with its 100kW transmitter at Rangitaiki near Taupo was opened on January 24, 1990, though the present aerial system restricts the station to frequencies between nine and 17MHz. New aerials are to be installed to enable broadcasts below 9MHz to be carried this winter. A projected frequency to be used between 1200 - 1800 is 6035kHz — in the past, 9510kHz has carried these all-night broadcasts.

SOUTH AFRICA: Channel Africa, formerly RSA Johannesburg, broadcasts in English at 0200 - 0400 on 11,745kHz; 0300 - 0500 on 7270kHz; 0400 - 0500 and 0600 - 0700 on 15,430kHz; 1000 - 1100 on 17,780kHz; 1100 - 1200 on 11,900kHz; 1600 - 1800 on 5960kHz; and 1600 - 1800 on 15,430kHz.

TAHITI: Papeete is the site of broadcasts from French Polynesia, and transmissions have been heard on a new channel 15,175kHz at 0500 instead of the former frequency of 15,170kHz. On the adjusted channel Tahitian is heard to 0500, then a broadcast in French which is still audible at 0800. Some interference from Radio Moscow is experienced around 0600, while later the other two channels from Tahiti (6135 and 11,825kHz) can also be heard.

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features an easy listening format and can even be heard in Australia.

The New Zealand Post, in saluting this radio pioneer, reported that, following the success of the Otago Radio Association, the country became wildly enthusiastic about the new-fangled 'wireless' which could pick up voices and music from the air.

By the end of 1927, more than 30,000 homes had radio licences. The Radio Broadcasting Company of New Zealand, which was state operated, was established in 1925, and was the forerunner of the present Radio New Zealand.

Japan upgrades service

March will see the introduction of Radio Japan's expansion at its Yamata transmitting site, 60km north of Tokyo, when its three new 300kW transmitters commence operation.

The site is also being extended to include three new antennas, and as a result, reception conditions are expected to improve — especially in China and South-east Asia. Radio Japan's broadcasts are transmitted by a digital line unit from the NHK Broadcasting Centre to the Yamata Transmitting Station.

Radio Japan is the country's international voice on shortwave. The station began its operation in 1935 using the slogan, 'Radio Tokyo'. It continued to broadcast during the war years and was clearly received in the South Pacific, having many — now notorious — announcers, including Tokyo Rose.

After the war, the external broadcasting was reorganised to transmit a total of 48 hours in 22 languages daily; and these hours have gradually increased, totalling 52-1/2 hours a day last December.

Radio Japan also uses relay stations to reach the target area with a better signal. These include the Moyabi Station of Africa No 1 in Gabon, RCI's Sackville Station in Canada, the Montsinery Station of RFI in French Guiana, SBC's Ekala Station in Sri Lanka and the BBC Station at Skelton.

Transmission to this area from Tokyo include a general service 0900 - 1000 on 11,815 and 11,840kHz and a special service to Australasia 0900 - 1000 on 15,270 and 17,860kHz.

Israel maintains schedule

Despite threatened budget cuts which reduced the English output to two sessions a day, a large schedule is now back in place. Recently KOL Israel, the External Service, announced the replacement of most of the sessions which were cancelled.

English is now broadcast six times daily, according to the following schedule: 0500 - 0515 on 9435kHz; 1100 - 1130 on 17,545kHz; 1400 - 1425 on 11,587, 11,603, 15,640, 15,650, 17,575 and 17,590kHz.

From 1800 - 1815 the frequencies are 11,587, 11,675 and 17,575kHz; 2000 - 2030 on 7465, 9435, 11,587, 11,603, 11,675 and 17,575kHz; and finally, 2230 - 2300 on 7465, 9435, 11,603, 11,675 and 17,575kHz. The transmissions for Australia are at 0500 and 1400.

As is the case of most European and Middle East countries, summer time is observed from March 29, through to the last Sunday in September. Therefore, Israel and other countries which relay the Domestic Service on shortwave will be heard one hour earlier.

Daylight saving

The confusion caused in Australia by daylight saving being introduced only in Tasmania, Victoria, New South Wales and South Australia has not disrupted the schedules of the ABC Inland Service, as Queensland, Northern Territory and Western Australia remain on Standard Time.

There are, however, five time zones across Australia during the period of daylight time. This means that the Eastern states, except Queensland, are now 11 hours, and South Australia 10-1/2 hours, ahead of UTC. Daylight time remains in operation in these states until March 7, 1993.

New Zealand has extended its daylight time over recent years, and it now occurs from the first Sunday in October until the third Sunday in March. This means that daylight time will end in New Zealand on Sunday March 21.

Worldwide, there have been similar changes. Portugal has decided to officially accept daylight time throughout the whole year, and is now permanently one hour ahead of UTC, instead of being on UTC during its winter months.

In Latin America, Argentina is now two hours behind UTC; Brazil is running two time zones, with Brasilia on daylight time which is two hours behind UTC up to February 13, 1993; Chile is using a time zone three hours behind UTC until March 12, 1993; while all other South American countries remain on standard time, except Ecuador, which is now on a new permanent time zone, four hours behind UTC. ❖

This item was contributed by Arthur Cushen, 212 Earn St. Invercargill, New Zealand who would be pleased to supply additional information on medium and shortwave listening. All times are quoted in UTC (GMT) which is 11 hours behind Australian Eastern Daylight Time and 13 hours behind NZ Daylight Time.

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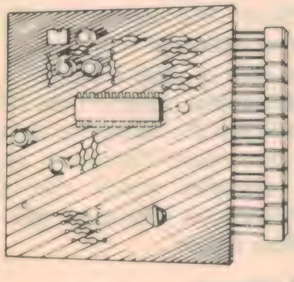
Top quality kits plus three exciting new releases!



LED VU METER
EXCLUSIVE TO US!

Designing your own Audio system or just updating old style equipment that uses an analogue VU meter, this unit offers the advantages of fast response and peak hold display. Comes with PCB, red, yellow and green LEDs plus all necessary components and hardware.

- Shortform kit
- 12 LEDs (red, yellow & green)
- Can operate from a supply voltage of between 11-40volts

Cat K-5370

NEW $24.95

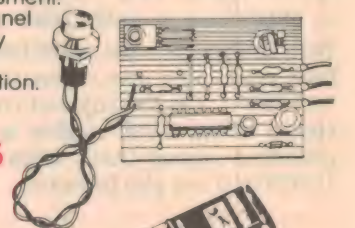
Cat K-5370

Feb '93

LOW FUEL INDICATOR

If you've ever run out of fuel in your car, you'll see the value of this low-cost kit. It lights a 12V warning lamp when the fuel drops below a pre-determined level. Harder to ignore than your standard gauge, the light could save you a great deal of inconvenience and embarrassment. Comes with PCB, case, 12V panel mount lamp and all necessary components, including auto connectors for ease of installation.

Cat K-4210



NEW $14.95

Feb '93

VK POWERMASTER MK 2

The new and improved Powermaster Mk2 kit gives you all the power you'd ever want for transceiver and bench-top power installations. Its flexible design allows you to choose the appropriate transformer for your desired power output level, opening up many possibilities for customising your own particular installation.

For example:

TRANSFORMER	CURRENT RATING: CONTINUOUS	PEAK (1 MINUTE)	SURGE (PULSE)
M-2000	5A	10A	25A
M-2010	8A	20A	25A
UPGRADED M-2010	15A	20A	25A

For those who remember the original Powermaster, the addition of a 20A panel meter to the kit plus provision for an optional 12V cooling fan will make even higher power configurations possible with perfect safety. On the cosmetic side, the supplied case is now an attractive black powder-coated steel unit - an advance over the previous bare aluminium box. Other improvements include: A front-panel overload protection reset switch and a primary slow blow fuse with fingerproof fuse holder. The kit includes all components (excepting those that depend on your choice of transformer), all hardware and a pre-punched silk-screened chassis.

Cat K-3400

EA JAN'93

NEW $189

FM RADIO

New to kit building? Then try this as an ideal first project! This simple FM radio receives all of your favourite FM stations, uses only two low-cost Integrated Circuits (ICs) and runs off a 9V battery. It's a great 'hands-on' way to learn about Radio Frequency (RF) circuits and Audio Frequency (AF) amplifiers. This short-form kit comes with FM radio IC & Audio IC, PCB, speaker, components and other hardware.

Cat K-5014 * Battery not included

$29.95

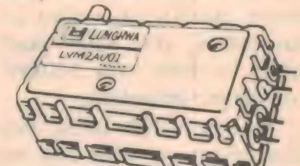
Nov'92

RF VIDEO MODULATOR

These are nearly $20 anywhere else! Convert your video or computer output to standard TV input with this Video Modulator. All the hard work's done... it comes pre-tuned and aligned and can be switched to VHF channel 1 or 0. Has RCA socket and built-in voltage regulator. (Complete with Data Sheet).

Cat K-6043

Unbelievable Low Price!

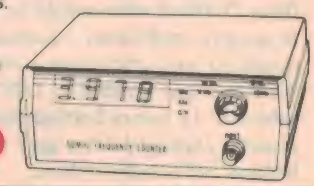


$9.95

50MHz FREQUENCY COUNTER

Low in cost, yet giving high accuracy, this low-cost 50MHz frequency counter gives you just about every measurement you need in this category - for far less money than comparable commercially available counters. Comes complete with all components, PCB, hardware, LED display, case, plug pack & a pre-punched silk screened front panel.

Cat K-7337



$119

PLEASE CHECK YOUR NEAREST STORE FOR AVAILABILITY, AS SOME KITS MAY STILL BE IN PRODUCTION.

Get into video for $64⁹⁵ uniden

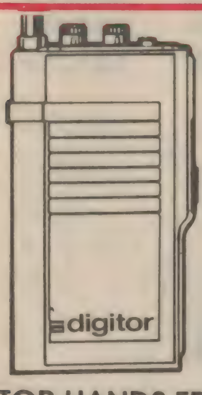
With sound, Cat L-5226 **$69⁹⁵**

Hurry in for these! Due to a scoop purchase, we have limited stocks of these 12cm (4.8") black & white NTSC video monitors - suitable for use in security systems or for any project you might dream up!
Cat L-5222

SCOOP PURCHASE

Specifications:

CRT size:	12cm (4.8")
Video Input:	NTSC, 1.5V P-P B&W
Scanning Frequency:	Horizontal - 15.7KHz Vertical- 60Hz
Horizontal resolution:	525 lines
Audio output (Electret mic.):	170mW 16OHM (L-5226 only)
Dimensions:	195mm L x 145mm W x 140mm H
Power Source:	13.5-15V DC, 600mA



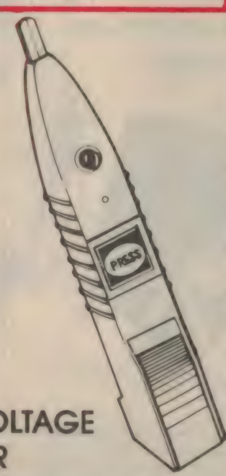
DIGITOR HANDS-FREE 55MHz TRANSCEIVER

With up to 500m range and no license required, this is an ideal local-area or first-time-user transceiver. Powered by a 9-volt battery, it comes complete with belt clip and an earpiece/tie-clasp microphone for hands-free use. Has selectable push-to-talk or voice activation and a sensitive dual conversion receiver.
Cat D-1095 **$69⁹⁵ ea**

DIGITAL ACCESS KEYPAD

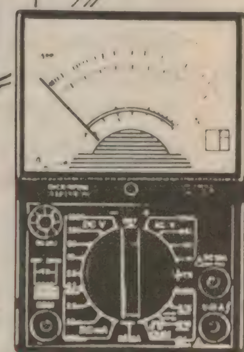
A digital keypad with raised keys that can be fitted to alarm systems, security door applications, etc. It comes with a mounting block and is finished in brushed stainless steel.... so it looks great. It's fitted with a tamper switch for added security.
Cat L-5284

SAVE $20 **$49⁹⁵**



AC VOLTAGE FINDER

Now there's no need to put yourself at risk! This device detects the electromagnetic field surrounding cables, sensing any AC voltage above 120 volts and warns you with both an LED and an audible "buzz". At this low price, there's no excuse for not having one!
Cat Q-1531 **$16⁹⁵**



ANALOGUE MULTIMETER

A high quality multimeter with a 3 ½" mirrored scale and 25 ranges plus DB. Safety features include overload protection as well as diode & fuse protection. In addition, it has an automatic TR (transistor) quality and type checker (ie - PNP or NPN), 1.5 & 9V battery checker, continuity test and temperature measurement (-20°C to 150°C). Comes complete with a temperature probe and tilt stand.

- 25 ranges plus DB
- Sensitivity: 20,000 Ohm/V
- DC Volts: 0.1, 2.5, 10, 50, 250, 1000V
- AC Volts: 10, 50, 250, 1000V
- DC Current 50uA, 2.5mA, 25mA, 250mA, 10A
- AC Current: 10A
- Resistance: x1, x10, x1K,x10K
- Temperature: -20°C to 150°C

Cat Q-1028 **$69⁹⁵**

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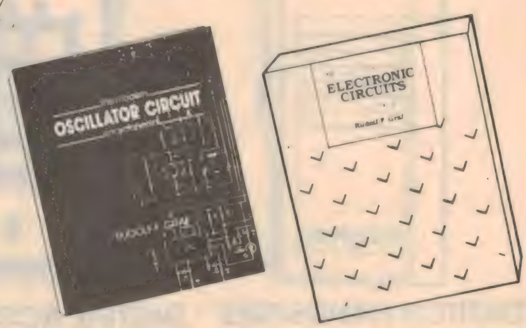

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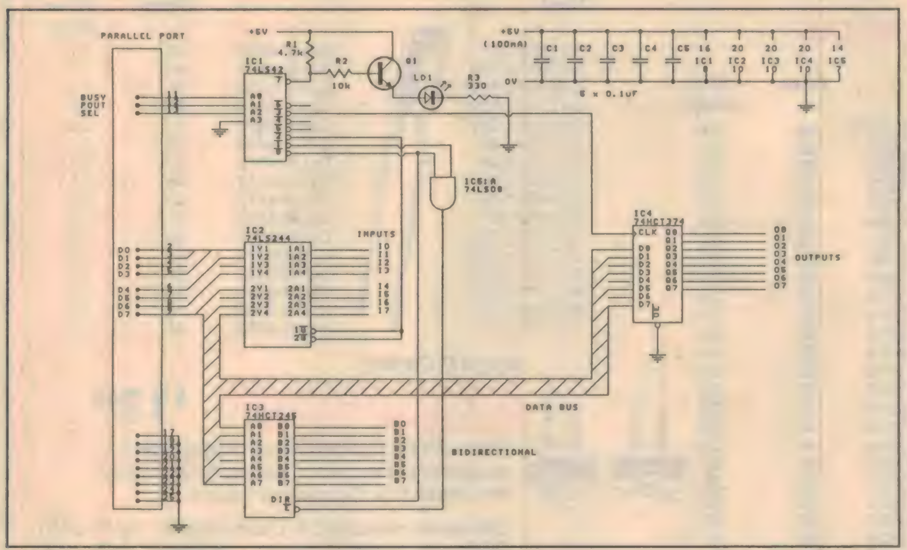
Circuit & Design Ideas

Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide further information.



I/O for the Amiga

Here is a circuit which uses the parallel connector, which can be extended to a maximum of 56 I/O lines, with the possibility to realise a bi-directional port. It was designed for the Amiga 500, but will work well on any Amiga — provided that it is not one of those models that uses a non-standard parallel port.

Output lines BUSY, POUT and SEL on the parallel connector of the Amiga can be programmed to supply a 3-bit address selection code which is applied to binary decoder IC1 (74LS42). Only one of the outputs of IC1 is low at any time. These are used to select the input/outputs.

As shown on the schematic, only the first four outputs are used to address various functions. Outputs from pins 1 (read) and 2 (write) address the bi-directional transceiver IC3; pin 3 addresses the octal bus buffer IC2 to enable computer inputs; and pin 4 addresses the latch IC4 for outputs. Addresses 4-6 are available to control another 24 I/O lines (3 blocks of 8); while address 7 is not used for I/O but rather is used to drive the 'ready LED' LD1, to show when none of the ports on the I/O extension are in use.

It should be noted that IC3 is not a latch, which means that it can only output data whenever it is being written to by the microprocessor. Output port IC4 does have a latching function, so that data words are kept stable on outputs until overwritten by the microprocessor.

The I/O extension should be fed from a separate +5V power supply, capable of providing 100mA. The three unused sections of IC5 should have their inputs grounded (pins 4,5; 9,10; 12,13). The computer input ports must not be written to, and the 'init' subroutine needs to be called only once, at the beginning of the program.

The accompanying listing (in Microsoft Amiga BASIC) is intended as a guide to writing software for the I/O extension. The instruction:

a=1: n=123: GOSUB WriteData

sends 123 (decimal) to IC3, which then functions as an output port, while:

a=2: GOSUB ReadData: PRINT n

reads the data word applied to IC3, and prints it on the monitor.

John De Sensi,
Moonee Ponds, Vic. **$40**

```
Init:
POKE 12571136&,199  'BUSY,POUT,SEL=output bits
POKE 12570624&,255  'select address 7 (light LD1)
POKE 12575489,0     'set port to input
RETURN
WriteData:
POKE 12570624&,248+a  'select address a
POKE 12575489&,255    'set port to output
POKE 12574977&,n      'write value
POKE 12570624&,255    'light LD1
RETURN
ReadData:
POKE 12575489&,0      'select port to input
POKE 12570624&,248+a  'select address a
n=PEEK(12574977&)     'read value
POKE 12570624&,255    'light LD1
RETURN
```

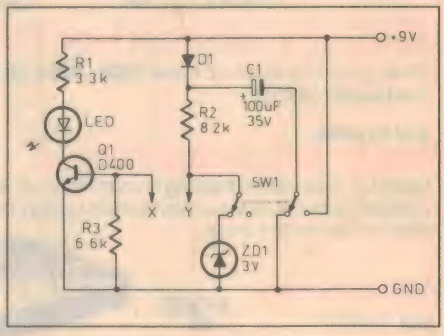
Transistor leads finder

The transistor leads identifier published in the March 1992 issue reminded me of a simple, reliable circuit which I have developed, using a different approach.

This approach makes use of the fact that the base-emitter junction of most transistors acts as a zener diode, with a breakdown voltage ranging from 5-16V. This does not occur with the base-collector junction until a far higher voltage.

The leads of the transistor to be checked are connected, two at a time to points X and Y. With switch SW1 in the left position (as drawn in the diagram), 3V supplied from the top of zener diode ZD1 is applied to the transistor at lead Y. This test is equivalent to the normal method of using an ohmmeter to identify the base, and whether the transistor is an NPN or PNP type.

However, instead of having to read the traditional low and high resistance values, a forward-biased junction between Y and X will simply turn on transistor Q1 and the



LED will glow. This will not happen for a reverse-biased junction.

While this test is in operation, capacitor C1 is charged up. By switching SW1 to its right position, approximately 18V is now applied to point Y. If the base and emitter of the transistor being tested are connected, then the LED will light no matter which lead is connected to X and Y — one way the junction is forward biased and the other is reverse-biased zener breakdown. But if it is the base and the collector that are connected, then the LED will light only for the forward-biased junction. Hence the emitter and collector leads can be differentiated.

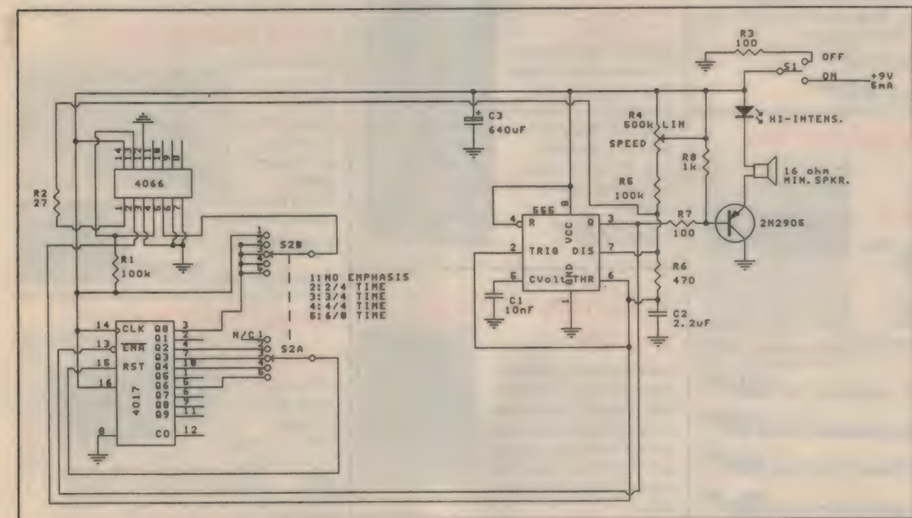
Darshan Ediriweera,
Thornlie, WA. **$50**

Metronome with emphasised beat

This is a designed for a metronome with emphasised beats, if required. Power consumption is small, allowing many hours from a '216' type battery. If beat emphasis is not required, the circuit to the left of the 555 can be deleted.

Firstly, the 555 timer is connected in astable mode to provide long 'high' and short 'low' pulses into the 2N2905. This transistor drives the speaker and LED with short sharp 'tocks'. The size and the mounting of the speaker determines the timbre of the 'tock', while the shortness of the pulses doesn't distress the LED's ratings.

A five stage counter (4017) is used to control the emphasis timing. The output from pin 3 of the 555 is fed to pin 13 of the 4017 to advance the counter — this occurs on a high-to-low transition. Switch S2 selects the required timing, e.g., 3/4 gives 'tock tick tick'. This setting resets the counter when the third output goes high, to restart the sequence. Unless 'no emphasis' is selected, the output from pin 3 (Q0) of the 4017 is fed to the enable pin (E1, pin 5) of one of the four bilateral switches in the 4066. If Q0 is high, this switch is enabled, and pin 4 is connected to ground, thus disabling through pin 13 (E0) a second bilateral switch. Switch 1 is included to act as an inverter.



However, when Q0 is low, this second switch connects the 27 ohm resistor R2 in parallel with the 470 ohm mark/space timing resistor R6. When this occurs, the metronome produces a shortened 'tock' (now a 'tick'). The end result is a normal 'tock' for the first count of the series (Q0 high) and shortened 'ticks' for the rest of the sequence (Q0 low).

Pins 6 and 12 are connected to ground to disable the two unused bilateral switches. A 4066 chip was chosen over a 4016 because of its lower on-resistance. For the timer stability, the 2.2uF capacitor C2 is a polyester type, not an electrolytic; and the 100 ohm resistor R3 shunts the unused current from the 640uF capacitor C3 when the circuit is turned off.

Warwick Talbot,
Toowoomba, Qld. **$40**

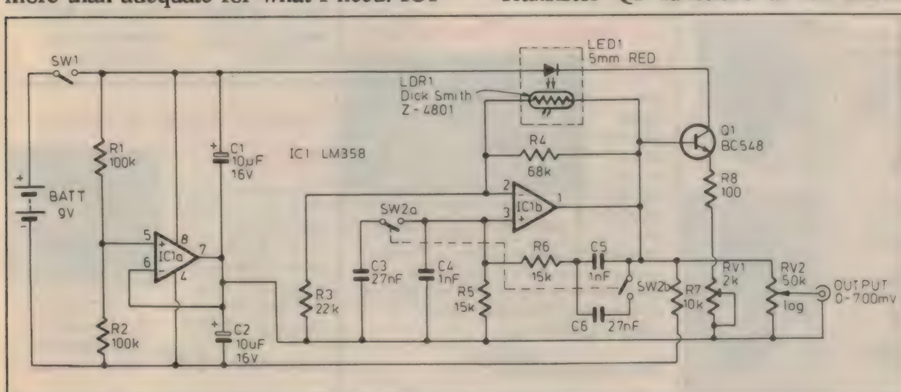
Audio test oscillator

I built this circuit to fill my need for a simple portable sine wave oscillator for fault-finding and adjusting hifi amplifiers, cassette desks, etc. It is based on a very simple diode-clipped Wien bridge op-amp oscillator circuit, which appears regularly in the Motorola Linear and Interface Circuits manual. I have extensively modified it to get the distortion down to a reasonable figure.

The circuit has virtually unchanged performance over a supply voltage range from 5 - 30V. At 9V the current consumption is only 1.4mA, with a measured distortion of 4% at 400Hz and 2% at 10kHz, according to a Leader LDM-170 distortion meter. These figures aren't brilliant, but more than adequate for what I need. IC1 (LM358) is a dual op-amp; IC1a is configured as a voltage follower, and its output — set at half the supply rail voltage — is used to provide a pseudo-ground for the actual oscillator circuit based on IC1b.

Switch SW2 selects the frequency: 10kHz when open and 400Hz when closed. If you want a single frequency approximately between these limits, delete C3, C6 and SW2, and make C4 = C5 = 10610/f, where 'f' is the desired frequency (Hz) and the answer is in nF. Control of the oscillator's amplitude and linearity is based on a technique which used to be common in valve equipment when DC control of gain was required (I'm showing my age!), namely the use of a light-dependent resistor and a light source. Here I've used a red LED and not a neon lamp.

Transistor Q1 functions as an active Class C detector; as the positive peaks of the output increase beyond its 0.6V emitter-base voltage drop, collector current begins to flow, causing the LED to glow. This in turn causes the LDR resistance to drop, increasing the level of negative feedback to IC1b, and holding the output amplitude essentially constant.



LDRs are quite slow-responding devices, which this circuit uses to its advantage. The delay provides a good amplitude control time constant, and 'filters out' the individual flashes of the LED.

I built the unit into a small 83 x 50 x 30mm plastic box, which still had enough room for a 216-type 9V battery. I mounted the LED with its bright end touching the front surface of the LDR, and enclosed the pair in black heatshrink tubing. If any ambient light is allowed to get to the LDR, the output level varies wildly and has 100Hz amplified modulation if the light source is artifical and runs on the mains.

The optimum maximum output level is about 700mV RMS (2V p-p), and this is adjusted by varying RV1. Above this level the minimum supply voltage increases, and substantially below it the output amplitude becomes unstable. The purpose of resistor R7? It increases the class A bias current of IC1b's output stage, preventing crossover distortion.

Bob Parker,
Carlton, NSW **$45**

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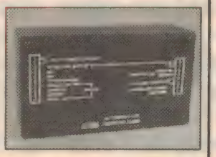
Protector Car Alarm Kit

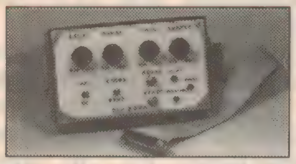


What a bargain! This amazing kit comes complete with 2 piezo siren, dash lamp flasher, battery back up, pin switches, sticker, case and all components required to assemble the kit. It even has an ignition killer built in. At this prices they won't last.

K 4370 NORMALLY $129.00

This Month Only $59.00

Digital Storage C.R.O. Adaptor for P.C.'s Kit



This great kit enables a P.C. user to capture a waveform and zoom in to segments of interest then save them to disc. The unit has 32K of storage memory and a sampling rate of over 600K samples per second. Input level of up to 2.5 Volt. Full sampling rate between 15K s/s to over 600K s/s. Input impedance of 1M ohm.

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These superb light-weight Hi-fi Stereo Headphones feature

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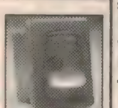

SPST chassis mount. With built in 240VAC Neon light.

S 3218 .99¢ ea

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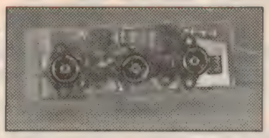

This kit enables you to transmit TV signals from the UHF output of your TV on your VCR to a second TV set in the house. The kit is complete with box and has a range of about 20 metres. Requires 12 Volts DC. (pictured without case-included).

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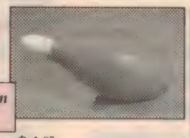

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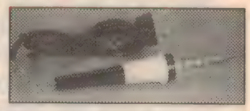

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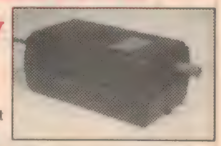

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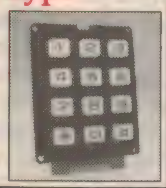

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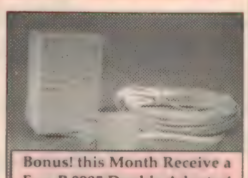

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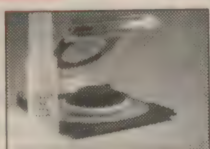
Jack O'Donnell

Jack O'Donnell
Managing Director

CD Cleaner



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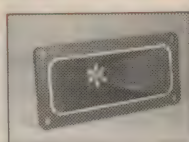

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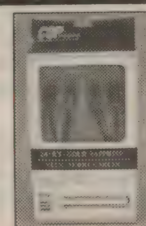

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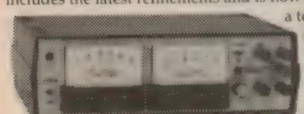
(EA May '85) *3-50 Volts at up to 5 Amps*

This supply has been one of our most popular. It includes the latest refinements and is now housed in a tough 'ABS' instrument case. This compact version uses a high efficiency toroidal transformer resulting in less heat and weight.



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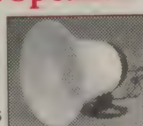

Economical and weather-proof this horn is ideal for alarms, CB's, PA etc. 10 watts.

C 2015 $15.95

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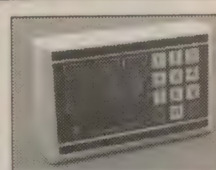

This alarm control panel features stylish and compact good looks It can be either surface or flush mounted to blend smoothly into any decor.

Features: • 4 digit PIN code to arm and disarm panel • 3 Independent Protection Circuits 24 hour fire/panic, external and internal (isolatable) • All Sectors are Compatible with NO and NC Switches • All Sectors are Sealed with End-Of-Line Resistors • Adjustable Timers for Entry Delay and Siren Duration • Fits Into standard 3 gang wall plate • Plug in wiring harness supplied

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M 9090 Power Supply & Backup Battery to Suit **$69.95**

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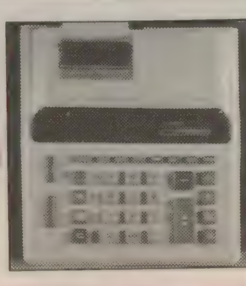

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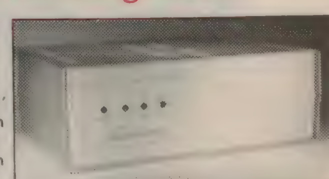

This great unit allows you to place calls on hold, intercom other extensions, answer calls from any extension and transfer calls. It is expandable up to 10 extensions, and is compatible with all DTMF (touch tone) telephones. Operation is as simple as pressing '*' to place a call on hold and press the extension number (0.9) and the respective station rings. Once answered you have a two way intercom with which you can announced call. To pick up the incoming call from hold press #. A neat feature is that all extensions will ring when an incoming call is placed on hold for 30 seconds so that it won't be forgotten. The basic kit is complete with power supply, case and facilities for 3 extensions. Extra extension boards allow expansion in multiples of 3. Fantastic for home or small office. No more shouting from room to room. Not Austel approved.

K 1430 Basic Kit **$189.00** **K 1435** Expansion Board **$79.95**

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★ ALTRONIC COMPONENTS ★

Construction Project:

Improved 50MHz Frequency Counter

Here's an updated version of our very popular low cost 50MHz Frequency Counter design. It uses readily available and current devices, and although you should be able to build it for around $100, it will nevertheless perform most of the frequency measurements generally needed.

by JIM ROWE

One of the most popular digital frequency counter designs we've ever published in *EA* was Mark Cheeseman's economy 50MHz model, presented in the May 1988 issue. Housed in a small plastic 'jiffy' box, it was one of the first in our still-running series of no-frills 'value for money' test instrument designs — which all have a deliberate emphasis on satisfying *most* (but not all) users' needs, at the lowest practical price.

By using a single low-cost 74C926 counter chip driving only four seven-segment LED displays, with a cheap 3.58MHz colour subcarrier crystal and single-chip divider for the timebase, Mark was able to produce a very practical and useful 50MHz counter which was sold by various firms as a kit for around $80 — well below any other kit counter, let alone commercial units. And fairly clearly this approach 'hit the spot' for many people, because it was very popular indeed.

However time moves on, and unfortunately some of the key components used in the May 1988 have recently been discontinued by their manufacturers, and are now either difficult or impossible to obtain. This is the case with the 74196 divider chips that were used in the prescaler circuitry, for example, and also with the MM5369EYR/N timebase divider chip.

In short, the design has become obsolete. But because of its popularity, we've decided to replace it with an updated design — to meet the obvious need for a low cost, utility counter. And that's the background to this present article.

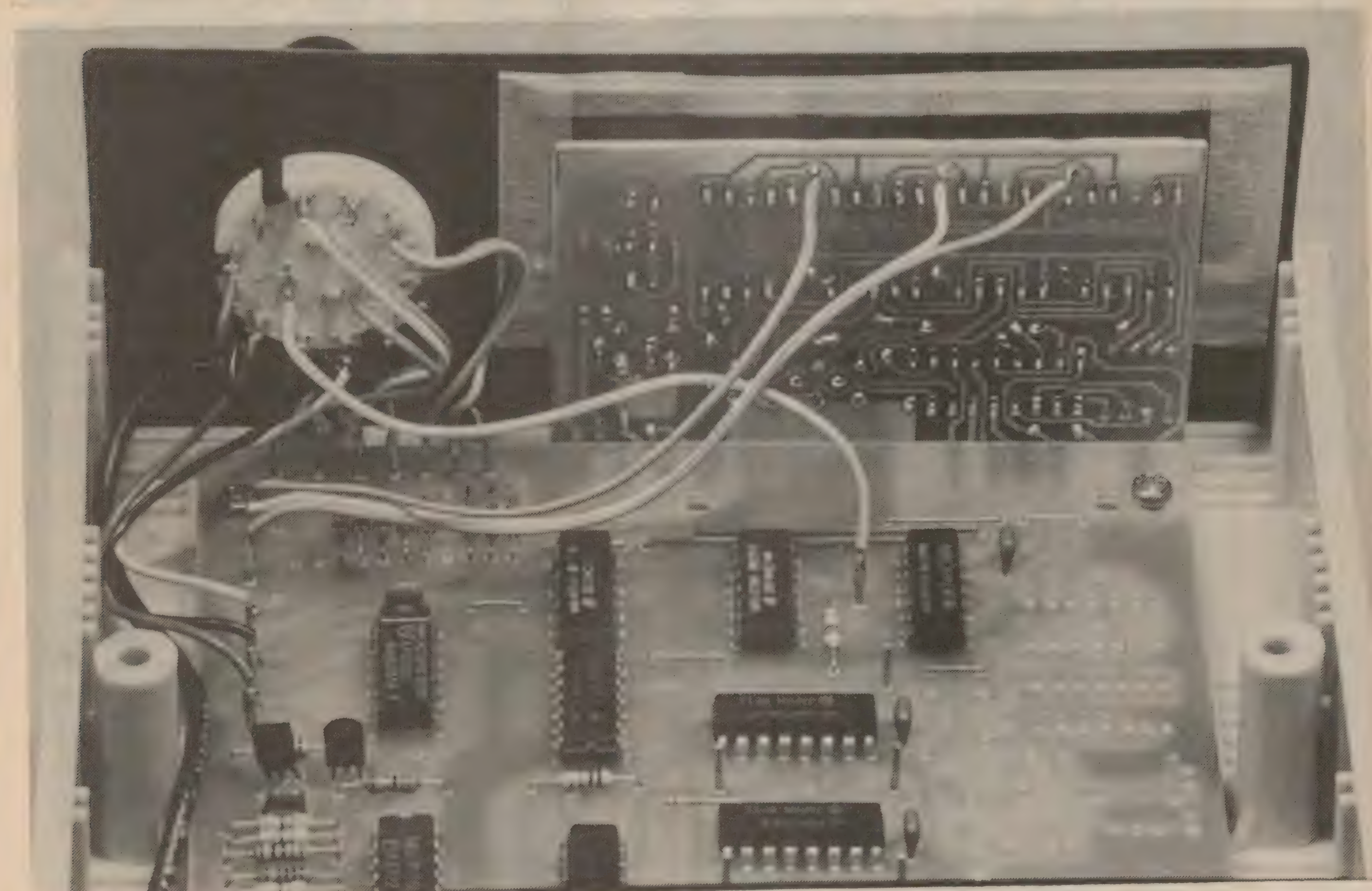
I claim no great originality for the new design, which is clearly based on the original. It still uses the low-cost

A close up view of the display board, which also mounts the main counter chip and multiplexing circuitry. Just visible at the bottom are the ends of the 10 PCB pins used to attach the display board to the front of the main board.

74C926 counter chip, driving four seven-segment LED displays, and also uses the same basic (and well proven) input signal conditioning circuitry. But the prescaler and timebase divider sections have been completely revamped, to use currently available chips, and this has also happened with the gating and 'housekeeping' logic.

The design has also been updated in the physical sense, to house it in one of the same low-cost plastic instrument cases which we've used for other more recent 'economy' test instruments. This gives it a much more professional look, and overcomes what was really the only criticism we heard about the original design: that its 'flat' shape didn't really lend itself to being placed on a typical instrument shelf.

Although we've been able to take advantage of recent advances in chip technology, in producing the new design, this hasn't *quite* balanced out the effects of inflation in the last four and a half years. As a result, the new counter *will* tend to cost you a little more than the original; according to our calculations, it will probably cost around $100. But this is still well below virtually any other build-it-yourself design, and will hopefully not lower its appeal significantly — particularly in view of its more practical shape and rather more professional appearance.

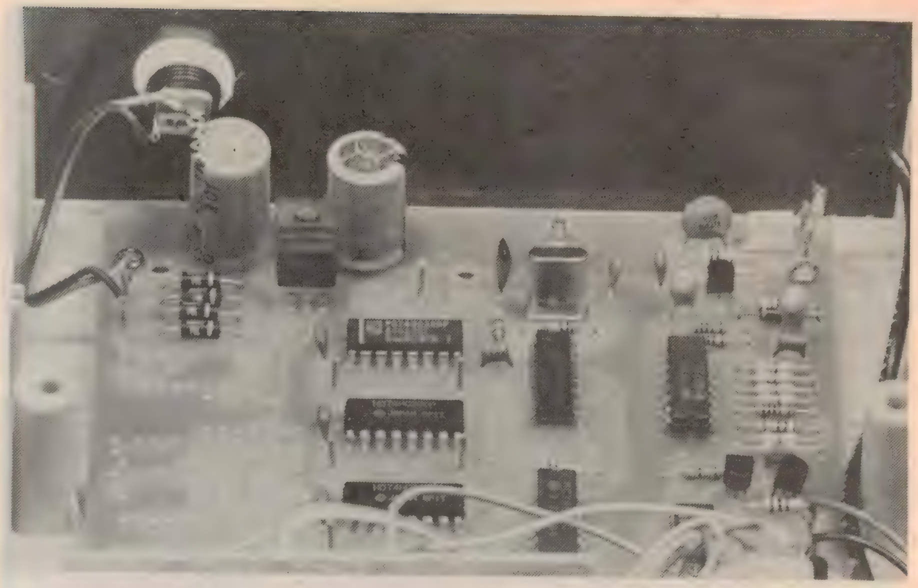


A view inside the counter case, looking towards the front. Most of the circuitry is on two printed boards, which attach together at right angles via 10 PCB pins. These perform most of the interconnections, as well as supporting the smaller vertical display board. Very few connections have to be made with conventional wiring, as you can see.

To suit the new case, the circuitry is now not on a single PC board but split between two, the larger of which carries most of the logic and mounts horizontally inside the case.

The smaller board carries the main counter chip and displays, and mounts vertically just behind the front panel. The two boards are designed to connect directly together via PCB pins soldered to pads, which makes the construction very little more complicated than if we had used a single board.

The new main PCB has in fact been designed to mate not only with the display board used in this project, but also with a larger 7-digit display board which will be presented shortly, as part of a new low-cost 1GHz counter — a 'bigger brother' of the current project. That's why some of the board isn't used, at present...



Another view inside the counter, this time looking towards the rear panel. Only one item is mounted on the latter — the DC input connector. Some parts of the main board are not populated for this counter, as is evident.

Circuit description

As before, the input signal to be measured is passed through a FET buffer stage (Q1), and then through a wideband preamp and squaring circuit, using an ECL triple line receiver chip (U1). All of this circuitry is well proven, and has not been changed.

Q1 is used to give the counter its high input impedance of approximately 1M (defined by gate resistor R2) in parallel with about 10pF.

Series resistor R1 and shunt diodes D1 and D2 form an input clipping circuit, to protect the FET from damage due to very large input signals.

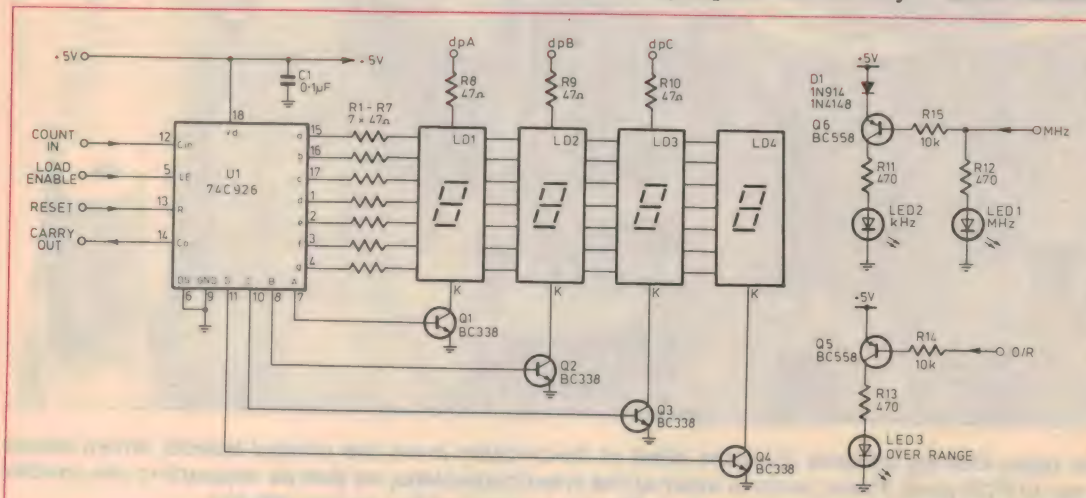
Capacitor C1 is simply to block DC, while C2 is used to compensate the divider formed from R1 and R2 for the effects of junction capacitance and minority carrier storage in D1 and D2, as well as the input capacitance of Q1 itself. This is necessary to ensure that the input stage operates efficiently to beyond 50MHz.

The first two sections of U1 are used as wideband amplifiers, with the third section configured as a Schmitt trigger with hysteresis, to square up the signal and effectively remove any accompanying noise.

Transistors Q2 and Q3 are used to perform level translation, amplifying the small output voltage swing from the ECL device so that it can be used to drive the following high-speed CMOS devices. The signal at the collector of Q2 is essentially a squarewave version of the input signal, of greater than 3V peak-peak. This signal can be fed directly to the gating and counter circuitry when low frequencies are being measured, but as the counter chip in particular can only operate to around 2MHz, higher frequencies must be divided-down or 'prescaled' first.

This is done by the two halves of U2, a 74HC390 dual bi-quinary decade divider. U2a is used to divide the input by one factor of 10 for the 10MHz range, while U2b divides by a further factor of 10 for the 50MHz range. As you can see from the schematic the prescaling of U2a is also used for the 100kHz range, to avoid the need for a third timebase gating signal.

Note that although the highest frequency range of the counter is nominally labelled '50MHz', the actual upper limit is determined by the maximum toggling frequency of U2, and to a lesser extent by the performance of U1. In practice and with typical devices, the limit for accurate counting can vary between about 45MHz and 70MHz.



The schematic for the rest of the counter's circuitry, mounted on the display board. As well as the main counter chip and multiplexed four-digit display, it also includes the kHz/MHz and over-range indication circuitry.

Switch SW1a selects either the direct or prescaled version of the input signal, and directs it to AND gate U8a. This is the main gate of the counter, to which we'll return shortly. At present though, the main thing to note is that U8a is 'opened' for either one second or 10ms, depending on the counter range that has been selected.

The output of U8a passes directly to the 74C926 counter chip on the display board, so the counter's output will give the number of input pulses that occurred during the time the gate was open — and hence give a reading proportional to the input signal frequency.

As you can see from the schematic for the display board, the 74C926 (U1) performs most of the 'hard part'. This chip combines four decades of counting logic with a multiplexing output decoder and display driver circuit, so that all that is needed to drive four seven-segment common cathode LED displays (LD1-4) are seven current-limiting resistors R1-7, and four digit switching transistors Q1-4.

The counter chip automatically multiplexes the displays, providing drive signals at digit outputs A-D to turn on each display's switching transistor as its particular digit codes are fed to the segment drive line outputs a-g. This all happens at a rate of around 1kHz, so all digits seem to be displayed simultaneously rather than in cyclic sequence.

One advantage of this system is that the 74C926 needs only 11 output pins to drive four seven-segment displays, allowing it to be housed in a low cost 18-pin plastic package. Another benefit is that because only one display is drawing current at any particular instant, the overall current drain is significantly reduced.

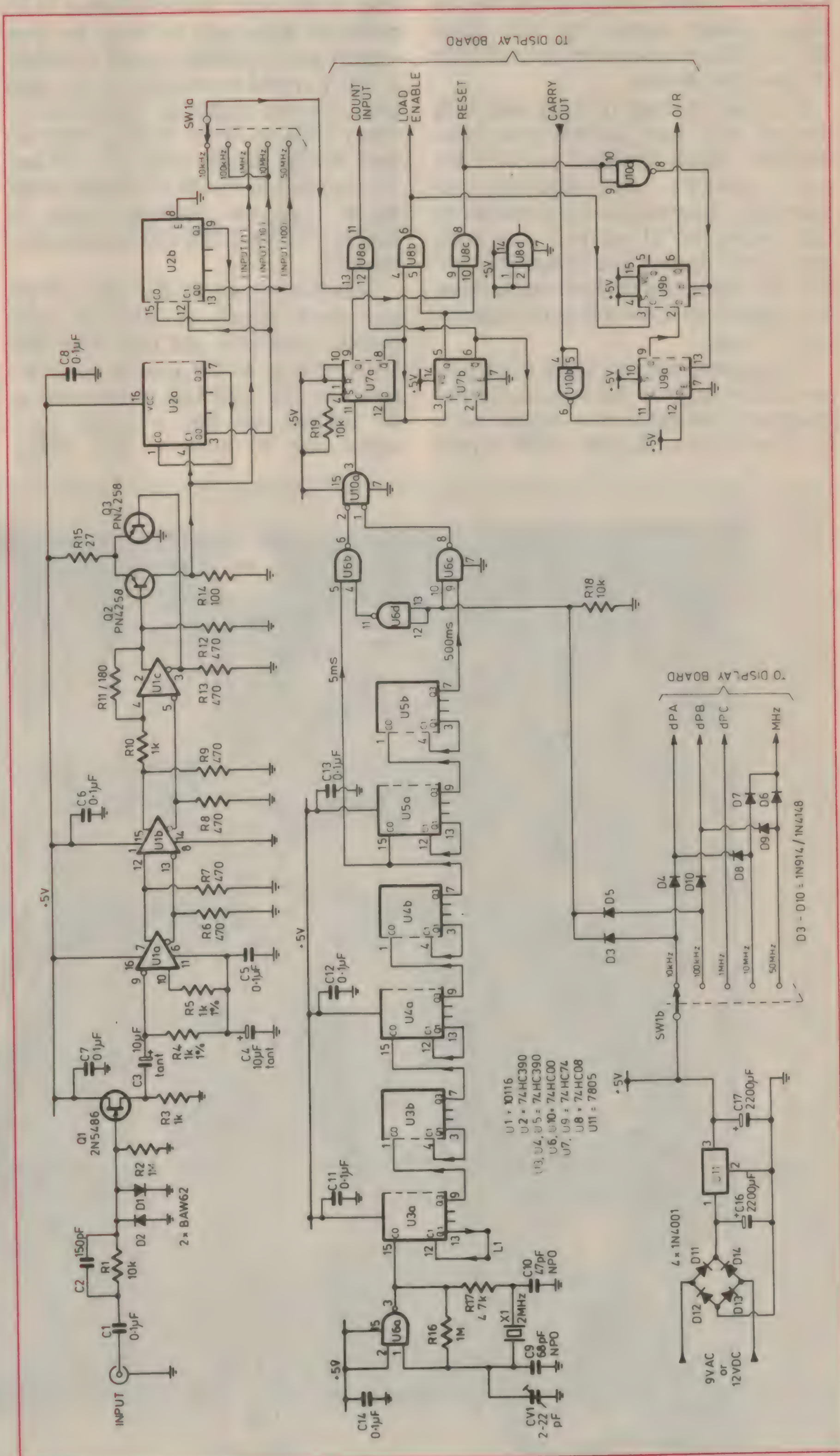
Note that the decimal point indicator LEDs inside the displays are not controlled directly by the 74C926, but are fed with a fixed control current via resistors R8, R9 or R10, from range switch SW1b. However since the decimal point LEDs share the same common cathode connections, their operation is effectively time-multiplexed as well, by default.

As you can see, the 74C926 has three signal inputs: a count input, a 'load enable' input and a reset input. It also has a 'carry' output, which we'll discuss soon.

In normal operation, the counters of the chip are first reset to zero, with a pulse fed to the reset input. Then input pulses are fed to the count input, during an accurately gated counting period. After this, the count is transferred into the chip's internal data latches by a pulse fed to the load enable input, for multiplexing to the displays. The sequence then repeats over again, for the next measurement.

To see how this reset-count-latch sequence is generated, we need to return to the main schematic.

The load enable and reset pulses needed by the 74C926 are generated by gates U8b and U8c, and these along with



Here is the schematic for the main board section of the counter. Much of the circuitry is very similar to that in the earlier version, but the timebase oscillator and divider chain in particular have had to be redesigned.

the main gate U8a are controlled by signals from the two halves of U7, a dual D-type flipflop (74HC74). The flipflops in turn are connected as a simple two-bit binary timing counter, fed with either 5ms or 500ms clock pulses derived from the timebase divider.

It is the cycling of U7a and U7b through their four possible state combinations which therefore produces the main counter's reset-count-latch sequencing. The reset pulse is produced by U8c during the '11' counter state; main gate U8a is opened during both the '00' and '01' states; and the load enable pulse is produced by U8b during the remaining '10' state.

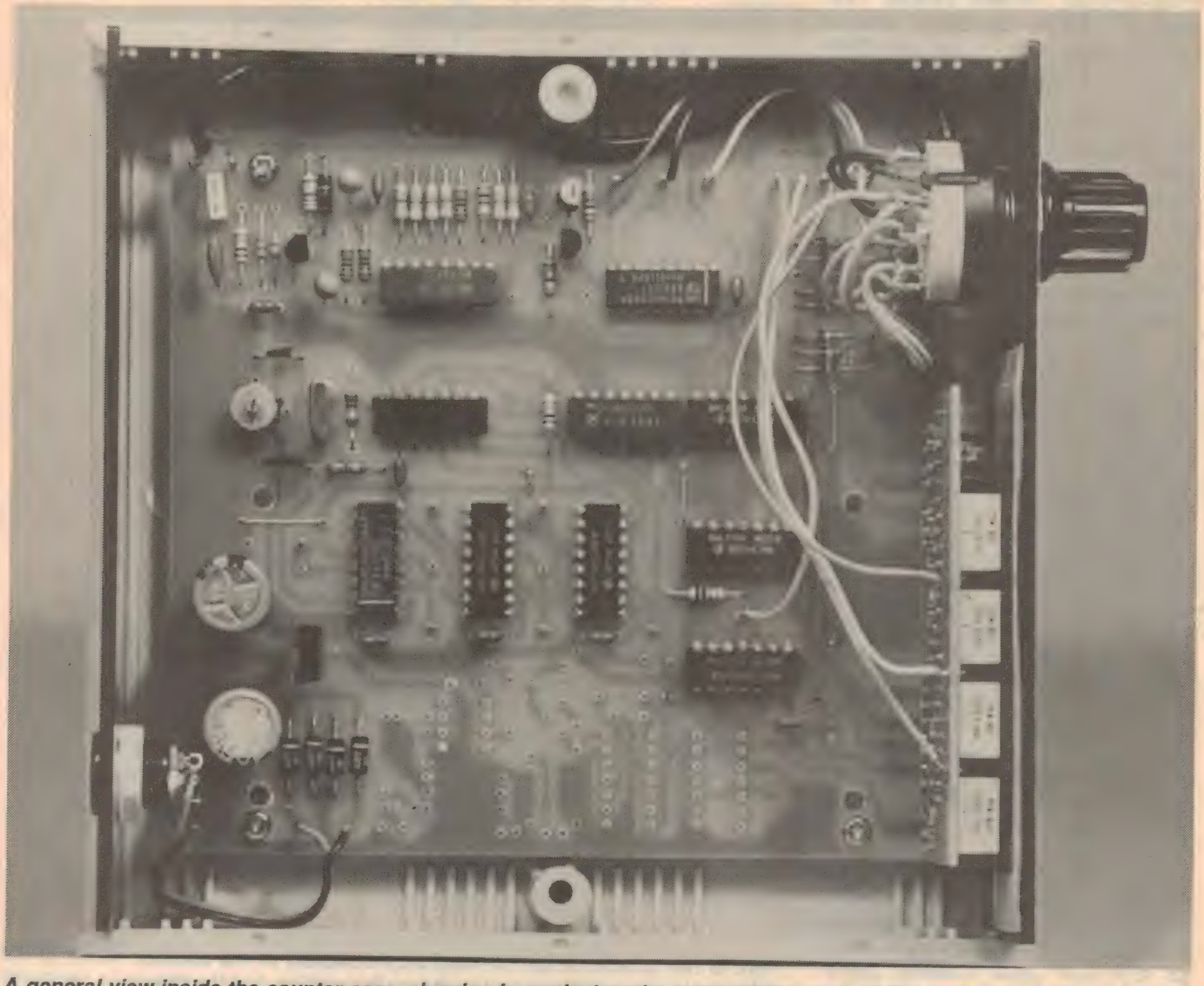
The accurate 5ms or 500ms clock pulses used to achieve this sequencing and gating are derived from a crystal oscillator, using gate U6a and 2MHz crystal X1. The exact frequency of oscillation can be 'pulled' using trimmer capacitor CV1, for counter calibration.

A 2MHz crystal is used in the new design because now that the MM5369 chip is no longer available, there is no particular advantage in using the previously used 3.58MHz crystal. Currently a 2MHz crystal is available for the same price, and this makes the rest of the circuitry simpler. Three further 74HC390 dual decade divider chips U3, U4 and U5 are used to divide the 2MHz clock signal from the oscillator down to 200Hz (5ms) and 2Hz (500ms) for driving U7a.

Selection of one or the other of the two clock signals is achieved using NAND gates U6b and U6c, with gate U10a used as an OR gate to direct the pulses to U7a. Gate U6d is connected as an inverter, so that a single logic signal can be used to open either U6b or U6c depending on the counting range selected via SW1b. This is done via diodes D3 and D5, with resistor R18 used to ensure that pins 10 of U6c and 12/13 of U6d are pulled to the logic low level when neither D3 nor D5 is conducting.

Note that SW1b is connected so that D3 and D5 are fed with +5V only for the 10kHz and 100kHz ranges. As a result the 500ms clock pulses are selected by U6c for only these two ranges, with the 5ms pulses used for the other three ranges. Hence the main counter chip is arranged to count for exactly one second on the two lowest ranges, and exactly 10ms on the three higher ranges.

The reset and load enable pulses in each case are 500ms and 5ms long respectively, so the counter's readings are 'updated' every two seconds on the two lower ranges, and every 20ms on the higher ranges. This is a very simple sys-



A general view inside the counter case, showing in particular where everything goes on the main board. Use this shot, together with the overlay diagrams, as a guide when you are wiring up your unit.

tem, but it works out quite conveniently in practice.

With any digital counter reading, it is always important to know if the counter has overflowed or 'gone around the clock', before ending up at the reading displayed. This is particularly relevant in a counter like the present one, with only four displayed digits.

Because of this, the circuitry around U9, U10b and U10d is used to process the 'carry out' signal from the 74C926, so that the 'over-range' indicator LED is activated whenever the counter does overflow during counting.

Gate U10b is connected as an inverter, feeding the carry out signal to U9a — wired as a clocked latch. As a result, U9a is 'set' if the final decade of the 74C926 returns to the low state during counting — implying that overflow has occurred. The state of U9a is then transferred into U9b by the 'load enable' pulse from U8b, and U9b therefore becomes the display latch for the over-range LED (LED3). This is driven by Q5 from the Q-bar output of U9b. Gate U10d, wired as an inverter, resets both halves of U9 during the reset phase.

As you can see from the main schematic, the second section of the range switch SW1b is used to select the decimal point indication for each range, as well as selecting the timing/gating clock signals via D3, D5 and U6. It is also used to operate the counter's 'MHz/kHz' indicator LEDs, again via a diode OR-gate system.

In this case the diodes are D6 and D7, which operate the 'MHz' LED (LED1) directly via resistor R12 (display board), when either of the two top ranges is selected. For the other three ranges, transistor Q6 conducts and illuminates LED2, to provide the 'kHz' indication. Q6 is held off by diode D1 when +5V is applied to the top of R12 by the conduction of D6 or D7, but when neither of these diodes is conducting, a small base current can flow through R15, R12 and LED1 — allowing the transistor to conduct.

In effect, the combination of Q6, D1, R15 and R11 forms a simple inverter, which turns on LED2 whenever LED1 is not on.

The power supply section of the counter is very simple. Diodes D11-D14 are connected as a bridge, so that the counter can be driven from either 9V AC or 12V DC, from any convenient source. Capacitors C16 and C17 are used for filtering and smoothing, while regulator U11 provides a well-regulated 5V rail for all of the counter's circuitry.

PARTS LIST

Main board

Capacitors

C1	0.1uF 100V MKT polyethylene
C2	150pF ceramic
C3,4	22uF 16VW tantalum
C5-8,11-15	0.1uF monolithic ceramic
C9	68pF NPO ceramic
C10	47pF NPO ceramic
C16,17	2200uF 16VW electrolytic (RB)
CV1	2-22pF trimmer, PCB mount

Resistors

(All 1/4W 5% unless specified)

R1	10k
R2,16	1M
R3,10	1k
R4,5	1k 1%
R6-9,12,13	470 ohms
R11	180 ohms
R14	100 ohms
R15	27 ohms
R17	4.7k
R18,19	10k

Semiconductors

D1,2	BAW62 fast switching diode
D3-10	1N4148 or similar silicon diode
D11-14	1N4001 or similar 1A diode
Q1	2N5485 or 2N5486 junction FET
Q2,3	PN4258 fast switching PNP
U1	10116 ECL triple line receiver
U2-5	74HC390 dual decade divider
U6,10	74HC00 quad NAND gate
U7,9	74HC74 dual D-type flipflop
U8	74HC08 quad AND gate
U11	7805 5V/1A regulator (TO-220)

Miscellaneous

X1	2.000MHz crystal, HC-49/U
SW1	2 pole 5-position rotary switch
PCB	PCB, 120 x 129mm, code 93C2A
J1	BNC connector, panel mounting
J2	2.1mm concentric DC power socket
Case	Plastic instrument case, 160 x 155 x 65mm (or 160 x 155 x 70mm)

9V AC or 12V DC 'plug pack' power supply; 16 x PCB pins; hookup wire; short length of 50-ohm coax; instrument knob; tinned copper wire for PCB links; solder, etc.

Display board

Resistors

(All 1/4W 5%)

R1-10	47 ohms
R11-13	470 ohms
R14,15	10k

Capacitors

C1	0.1uF monolithic ceramic

Semiconductors

D1	1N914 or 1N4148 silicon diode
Q1-4	BC338 or similar NPN switching transistor
Q5,6	BC558 or similar PNP switching transistor
LD1-4	FND560 or similar 7-segment LED display
	LED1-3 3mm LED, red
U1	74C926 CMOS quad decade counter/display driver

Miscellaneous

10 x PCB pins; tinned copper wire for PCB links

PCB	76 x 52mm, code 93C2B

Construction

As noted earlier, the new counter is built in the same small case used for many of our other economy instruments, measuring 160 x 155 x 65mm. And apart from the range switch, signal input connector and DC input socket, all of the components are on two PC boards.

The smaller of the two mounts vertically, behind the front panel, and supports the 74C926 main counter chip, the display driver transistors, the seven-segment displays and the indicator LEDs. The larger 'main' board houses the rest of the circuitry, and mounts horizontally in the lower half of the case.

The display board measures 77 x 52mm, and is coded 93C2B, while the main board measures 129 x 120mm and is coded 93C2A. The display board is attached to the front of the main board by soldered joints to 10 PCB pins, which also make most of the connections between the two.

The position and orientation of components on both boards should be fairly clear from the pictures and the overlay diagrams. Note that both boards require some wire links to be fitted — three in the case of the display board, and 10 in the case of the main board.

These are best fitted before any of the components, so that you don't forget them. In most cases they can be of unsleeved tinned copper wire (even component lead offcuts), but in the case of the longer links and those which run close to each other, insulated hookup wire would be a better choice.

After fitting the links, it's probably also a good idea to fit the PCB pins to the main board. Note that this does *not* include the pins used to attach and make connections to the display board; these are actually fitted initially to the display board itself, and in any case are best left until later. At this stage just fit those along the right-hand side, at the right-hand end of the front (to connect to SW1b), at rear left for the power input and also the single pin between U7 and U8, for the lead from the rotor of SW1a.

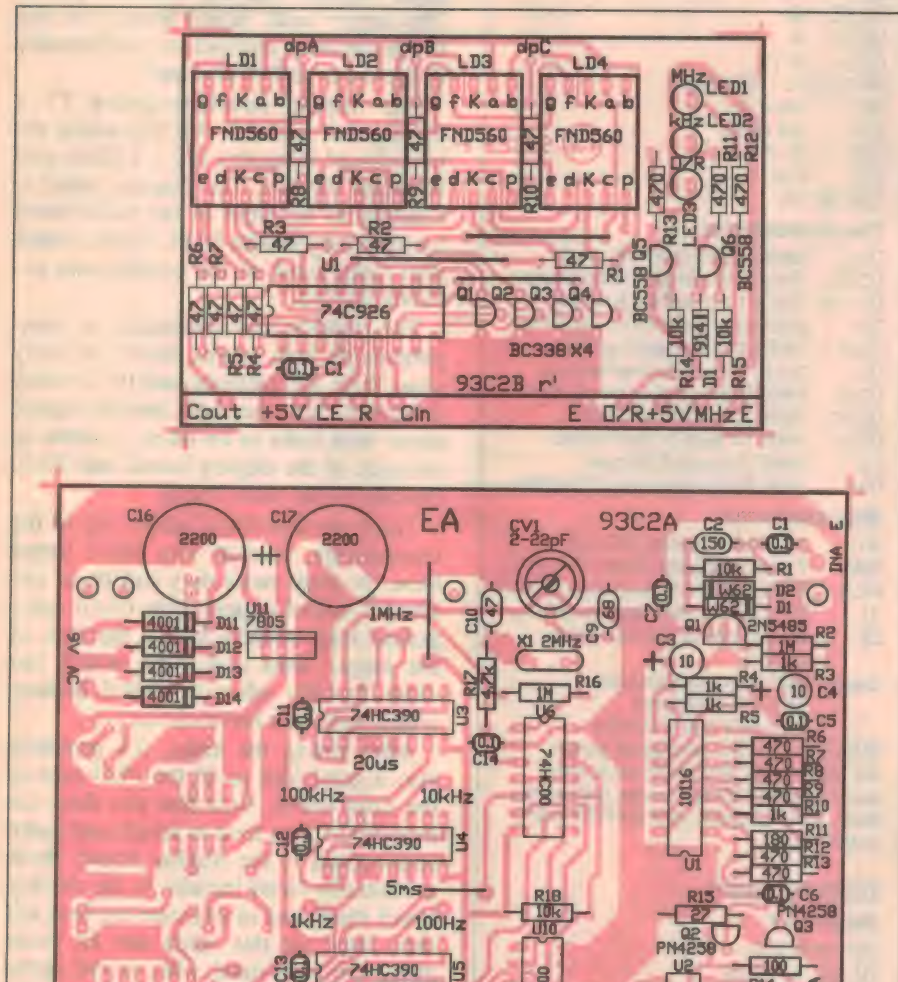
By the way, the main board also has provision for additional PCB pins, to allow connections to the various tapping points along the timebase divider chain (U3/U4/U5). You may wish to fit these pins also, so that you can make use of the crystal-derived reference signals at a later stage (for checking the calibration of a scope or receiver, for example). The signals available are marked on the overlay diagram, and comprise square waves of 1MHz, 100kHz, 10kHz, 1kHz, 100Hz and 10Hz.

Frequency Counter

The PCB also has provision for breaking the link between the binary and quinary sections of U3, in order to feed in an external higher-stability 1MHz timebase signal. Only a few builders are likely to want to do this, but the provision is there.

All you need to feed in an external timebase signal is cut the short track between the pad marked '1MHz', and the unmarked pad alongside. The existing pin becomes the external 1MHz timebase signal input, while if you wish a second pin can be fitted to the adjacent track to provide a separate 1MHz output from the internal crystal oscillator.

The suggested order of fitting components to the main board is resistors first, followed by the small capacitors, then the diodes, large capacitors, crystal, trimmer capacitor, transistors and finally the IC's. As usual, take care to fit all of the polarised components the correct way around, and solder the supply and earth pins of each IC first to minimise the risk of damage from electrostatic charges.



Shown here are the overlay diagrams for both boards, to help you in fitting all the components. As the main board is also designed for use in a larger version of the counter, some areas of the board are left blank in this model.

The power regulator chip U10 is not bent down against the board, but stands vertically. It does not *have* to be fitted with a heatsink, but will run somewhat cooler if you attach a small 'flag' type heatsink of the clip-on variety.

Much the same order as described above can be used to fit the components to the display board: resistors, capacitor, diode, LEDs and LED displays, transistors and finally the IC. Note that the LED displays should be fitted to the PCB so their decimal point LED's round 'window' is orientated towards the bottom of the board. The three single LEDs are orientated so that their cathodes (shorter lead, flat on plastic) are towards LD4.

When all of the components have been fitted to the display board, fit the 10 PCB pins by pushing them through the holes along the bottom edge of the board, from the copper side and with their *shorter* ends passing into the holes. Don't solder them to the copper as yet, though.

Now invert the main board, and offer up to its front edge the copper side of the display board, also inverted but at 90°. The pins attached to the display board should line up with the rectangular pads on the front of the main board, if you've done everything correctly. It's then a matter of holding the two tightly together at 90°, and soldering the pins to the copper on both boards.

This is a little tricky, but not unduly difficult if you use the right approach. I tacked the two end-most pins to the main PCB pads first, to hold everything together (relying on a friction fit of the pins in the display board holes).

I then soldered the pins one by one to their display board pads, and finally soldered them to the main board pads. Just to make sure, I even ran a fillet of solder along the centre section, where the two 'earth' copper areas meet. This is more than enough bonding between the two boards, to support the display board when the main board is mounted in the case.

At this stage you might like to fit the three wires which make the only other connections between the two boards: those for the decimal point drive. These are made using three lengths of standard insulated hookup wire (a three-conductor piece cut from 'rainbow' ribbon cable would be fine), about 130mm long. The connections are simple; the 'dpA' pad on the display PCB connects to the 'dp1' pin on the

main PCB, 'dpB' to the 'dp2' pin and 'dpC' to the 'dp3' pin.

With the two boards now fully populated and assembled together, you can mount them into the lower half of the case. You'll find that the four outermost 3mm holes in the main PCB line up with mounting pillar holes in the case, allowing you to use these for fitting the usual self-tapping screws.

At this stage you can turn your attention to preparing the front and rear panels. The rear panel requires only a hole to accept the DC power inlet connector, located so that the connector clears C16 when the panel is fitted into the case.

If you're building the project from scratch rather than a kit, the front panel will require a little more work and care. It has three holes: two small round one for the BNC input socket and range switch SW1, and a larger rectangular one for the display window.

I suggest you use a photocopy of the front panel artwork, reproduced here, as a template to guide you in locating and cutting these holes. Obviously it's worth taking care with the main rectangular hole in particular, because any crookedness or roughness will be very obvious in the final instrument.

To make the prototype unit look reasonably professional, we prepared a stick-on escutcheon from the artwork, using Dynamark photo-sensitive aluminium sheet (formerly Scotchcal). You may wish to do the same, or perhaps use a photographic bromide glued to the front panel instead.

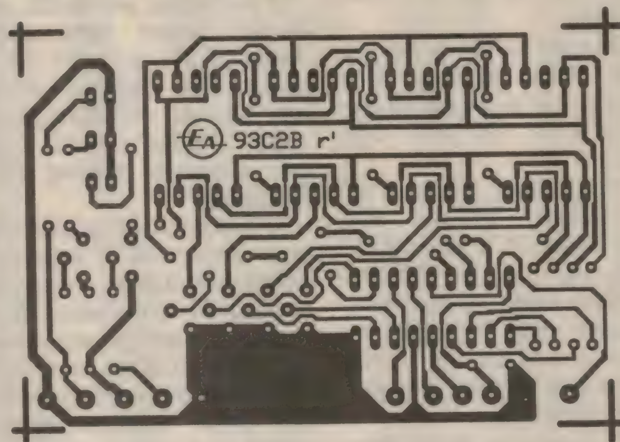
Either way, it would also be a good idea to attach a small piece of red or orange plastic sheet behind the display window, to act as a filter and improve the display's readability. The filter also tends to hide the minor components on the display board, around the LEDs and displays. I attached the plastic behind the front panel using masking tape, but you could probably use a few drops of cyanoacrylate 'super glue' for a more permanent job, if you're careful.

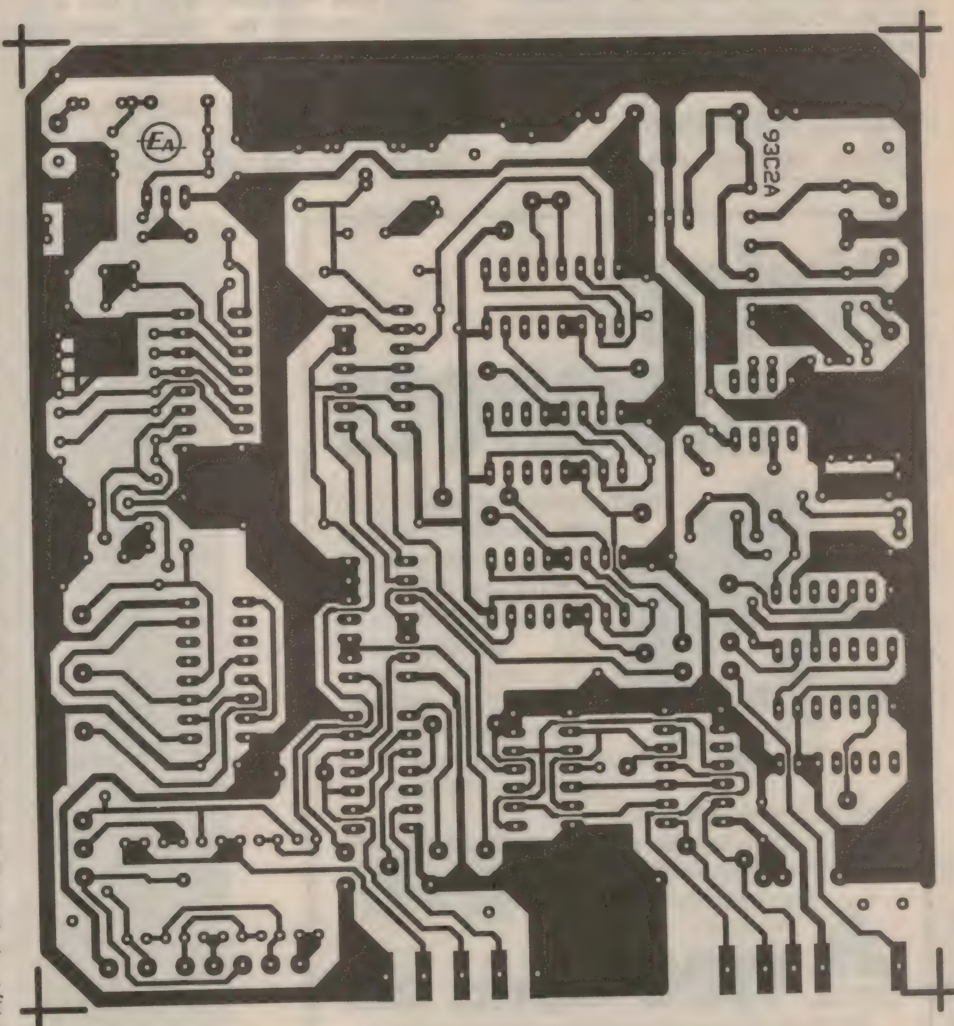
The input BNC connector and range switch can now be mounted to the front panel, after you've cut the switch shaft to length and filed off any burrs. Then fit the control knob, and your front panel assembly is complete.

The remaining phase is to fit the interconnections between the PCB assembly and the front and rear panels. There are only a very small number of these, and they're easily made with the front and rear panels lying flat and 'face down' next to their final positions. Two connections in ordinary insulated hookup wire run between the '9V AC' pins (near diodes D11-14), to the power input socket on the rear panel. The polarity isn't important here, because of the diode bridge. That completes the rear panel wiring.

The 'INA' and 'E' pins near capacitor C1 are then connected to the BNC input connector on the front panel, using light 50-ohm coaxial cable. The inner conductor of the cable connects from 'INA' to the connector centre lug, while the cable braid is used to connect the 'E' pin to the connector earth lug.

The remaining connections are those for the range switch SW1, and are again made in standard insulated hookup wire. Those for the SW1b side of the switch





Finally, the patterns for the two PC boards used in the counter, reproduced here actual size for the benefit of those who wish to etch their own.

PCB connecting to the rotor lug, and adjacent pins A-E connecting to the lugs for the ranges in ascending frequency order and clockwise rotation sequence. So pin 'A' connects to the '10kHz' switch lug, pin 'B' to the '100kHz' lug and so on. Note that PCB pin 'F' is not used in this version.

The connections for the SW1a side of the switch are almost as easy. The rotor lug connects over to the pin on the main PCB between U8 and U7, marked 'SW1a'.

Then three other wires are used to connect the 'INA/1', 'INA/10' and 'INA/100' pins on the PCB (near R14) to the switch lugs for the 10kHz, 100kHz and 50MHz ranges respectively. Finally, two further short lengths of insulated wire are used to link the 10kHz and 1MHz switch lugs together, and also the 100kHz and 10MHz lugs.

And that's all there is to the counter wiring. The front and rear panels can be swung up and slotted into position, and your counter should be ready for testing.

Testing, adjustment

Before applying any power, it's probably a good idea to check your wiring and assembly thoroughly, in case you've made any errors which could result in component damage. Look in particular for polarised components around the wrong way (IC's, transistors, diodes or electrolytic capacitors), uninsulated links touching, tracks on the PCB's bridged by solder, and so on.

If everything seems OK, connect the counter power input socket to a source of 9V AC, 12V DC or thereabouts. The displays should spring into life, and with the signal input connector 'floating' you'll very likely get a random reading due to stray RF pickup.

At this stage, try quickly checking the main supply rail of thecounter, with a DMM or multimeter. A convenient point to check this is thelink on the main PCB between C8 and U9; you can connect the negative lead of the meter to the link at the rear of the board, between C10 and the '1MHz' timebase pin. Your meter should read very close to +5V DC; if it doesn't, remove the power immediately and look for a wiring error or faulty component.

Adjusting the range switch should activate the three decimal point LED's and also the 'kHz' and 'MHz' LED's, in different positions. For example the 'kHz' LED should be lit for the three lowest ranges, and the 'MHz' LED for the two uppermost ranges. Similarly decimal point 'A' should be lit for the 10kHz and 10MHz ranges, point 'B' for the 100kHz and 50MHz ranges, and point 'C' for the 1MHz range.

Now try terminating the counter's input with a short cable and 50-ohm dummy load, or a shorted BNC plug. This will probably reduce the display reading to '0000'. The over-range LED should also extinguish, if it was originally lit.

If all has gone well so far, your counter is probably working as it should, and you're ready for the one and only adjustment required: setting its time-base oscillator to exactly 2MHz, for correct calibration.

This can be done quite easily, simply by adjusting trimmer capacitor CV1 for the most accurate reading, when the counter is measuring a reference signal of accurately known frequency.

Where do you get such a reference signal? Well, you can use the timebase signal from a commercial counter, or that from a crystal calibrator which has been set to 'zero beat' against a frequency reference signal from a shortwave station like VNG or WWV, using a communications receiver.

Or better still, probably, you can try measuring the line frequency of a TV set, when it is tuned to a national TV network and showing properly locked pictures. This should produce a reading flicking between '15.62' and '15.63' on the 100kHz range, or steady at '5.625' on the 10kHz range (in which case the O/R LED will be glowing).

Whatever the reference signal you use, CV1 is simply adjusted to produce the correct reading. If by chance you can't quite reach the correct reading, with CV1 at one or other extreme of its adjustment range, you may need to replace C9 with the next lower or higher value, to allow this to be done.

Although the values of C9, C10 and CV1 have been chosen to allow correct setting with most crystals, a few may be just far enough away in frequency to require a change in C9. Note that if you do have to replace C9 with a 56pF or 82pF unit, the substitute should again be an 'NPO' type (black band) to ensure best stability.

Once you've performed this calibration, your new counter should be finished. It only remains to attach the top of the case, fit the two screws which hold everything together, and it's ready for business. ❖

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3.5 DSHD	$12.95	$12.50	$11.95	$10.50	$9.90
5.25 DSDD	$4.30	$4.30	$4.30	$4.20	$3.95
5.25 DSHD	$8.10	$8.00	$7.90	$7.50	$6.60

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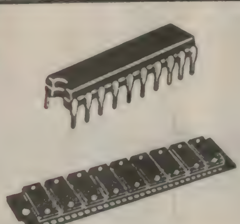

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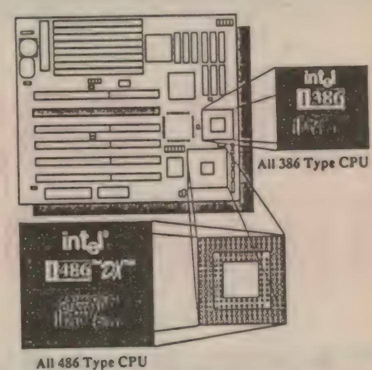

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Construction Project:

LOW COST DSO ADAPTOR FOR PC'S

Here is an easy to build unit which connects to the printer port of an IBM-compatible PC, and converts it into a digital sampling oscilloscope with a bandwidth of over 60kHz. Matching software available at low cost from the author allows you to display captured waveforms, zoom in on segments of interest, and also save waveforms to disk and retrieve them again at a later date.

by DAVID JONES

A digital storage oscilloscope or 'DSO' is a very important piece of test equipment, which can often do the jobs that a normal analog CRO just can't handle. Examples include capturing single-shot and widely spaced wave-shapes, and looking at complex signals that can't be readily triggered on a CRO.

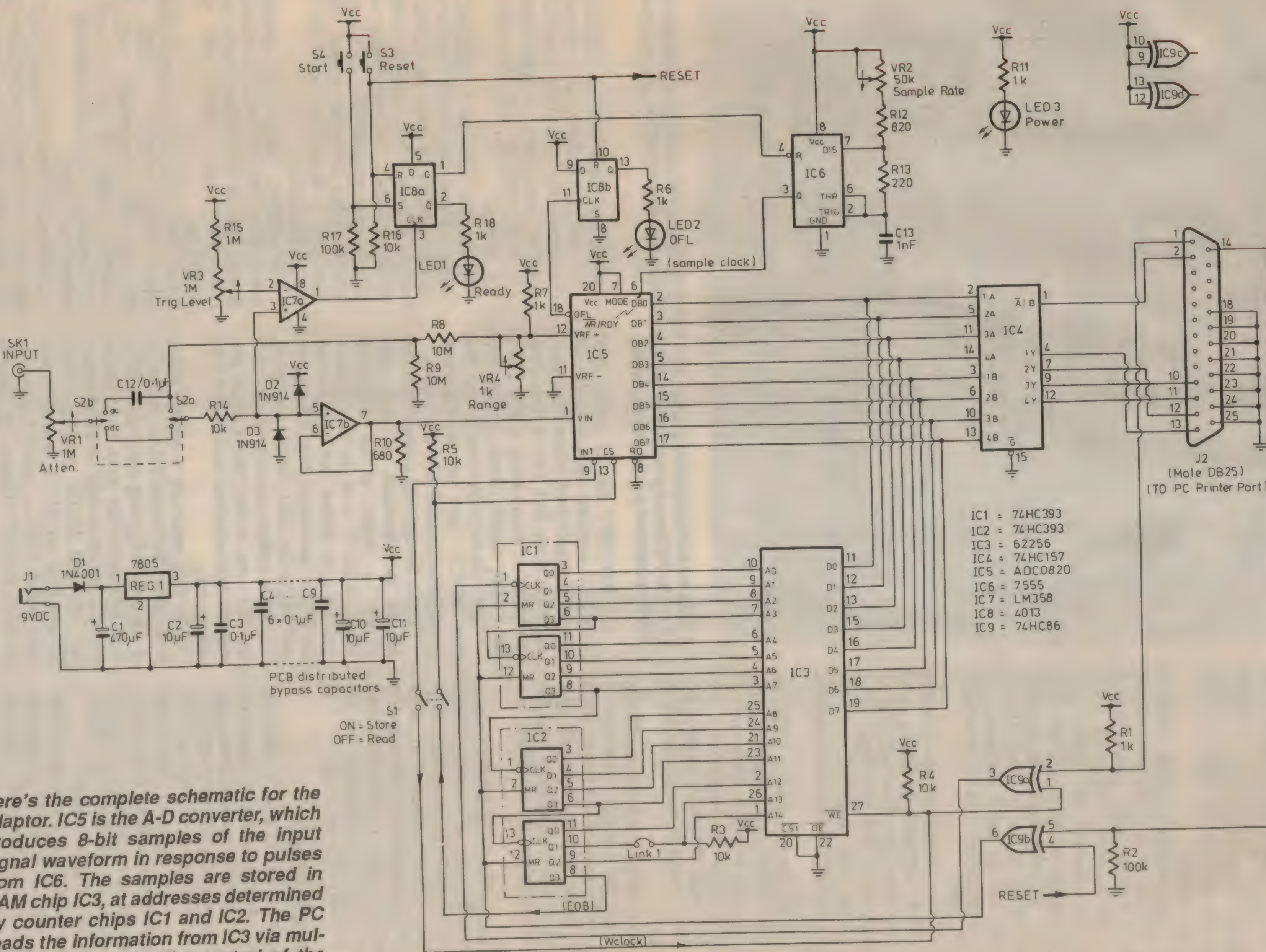
Unfortunately the cost of DSO's put them out of the reach of a lot of people, which is why projects that convert a normal CRO into a DSO have always been popular. But these have a few limitations, the obvious one being that you must have a CRO in the first place, and not everyone has (they're expensive too!). Most such adaptors also have a small sample memory, due to the limitations of a standard CRO screen, and there is generally no way to permanently store the waveforms for future reference and comparison.

Enter the PC-based Digital Storage Oscilloscope Adapter (DSOA), which takes advantage of an existing PC to provide a more useful range of features and facilities.

The DSOA to be described here interfaces to the parallel port of any standard IBM-PC compatible and has a maximum storage memory of 32K bytes (that's more than a lot of full blown DSO's), and a sampling rate of over 600k samples per second.

The stored waveform is read into the PC via the parallel port and displayed on screen, in virtually the same way as a normal CRO. But being PC-based gives the DSOA advantages such as being able to permanently load and save waveforms to disk, zoom in on any part of the waveform and superimpose two waveforms for comparison. A large screen display could also be useful for an audience.

The large sample memory is particularly useful for seeing such things as an amplitude modulated sinewave, or



Here's the complete schematic for the adaptor. IC5 is the A-D converter, which produces 8-bit samples of the input signal waveform in response to pulses from IC6. The samples are stored in RAM chip IC3, at addresses determined by counter chips IC1 and IC2. The PC reads the information from IC3 via multiplexer IC4, under the control of the author's software.

the detail of a video signal. With a small memory the replayed AM signal may well appear to have a constant amplitude, while in the case of a video signal you may not be able to see the 50Hz sync block!

The input sensitivity of the DSOA is fully variable, from a few hundred millivolts to tens of volts, with selectable AC or DC coupling. Triggering is obtained via a manual start button or a positive-going input level, variable from 0 to 2.5V. The sampling rate is also fully variable from 15ks/s to over 600ks/s. The unit has an input impedance of 1MΩ, which allows use of a standard x10 CRO probe.

One handy feature is an overflow LED, which will latch on during sampling if the input goes above the limit set by the range pot. This will show when an overflow has occurred, without having to read the data into the computer and display it.

The DSOA can use either a 62256 or 6264 static RAM chip, depending on availability; this will give either 32K or 8K samples of storage respectively. But there's not much difference in price between them, I suggest you get the 62256 if you can.

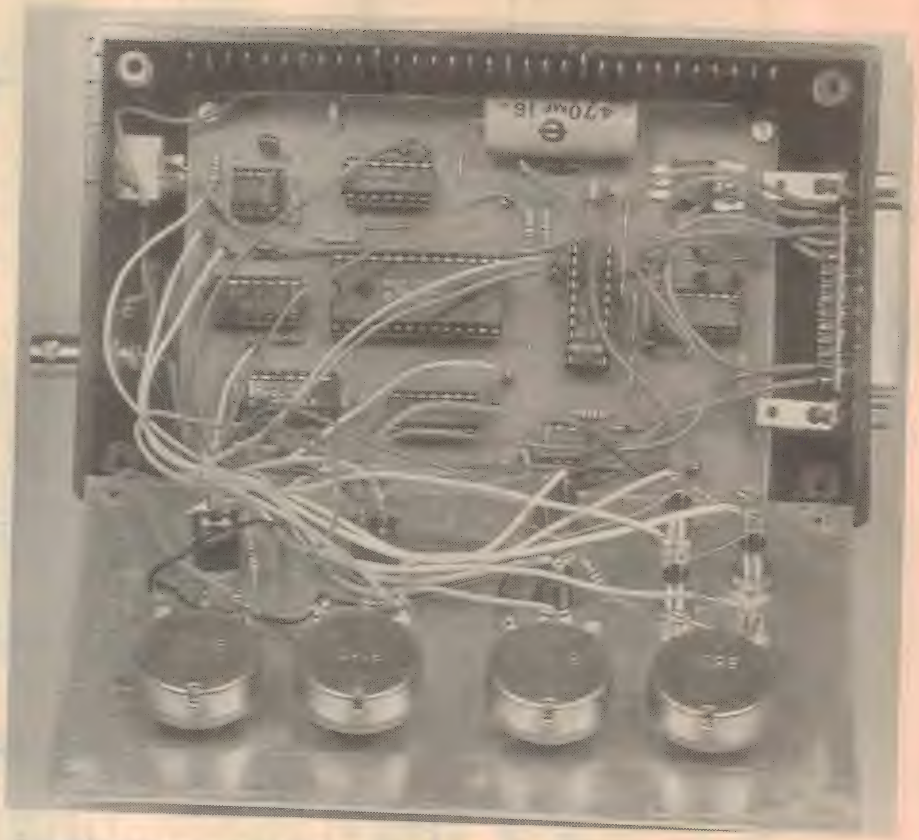
If a battery-backed nonvolatile SRAM is used, then the waveform will stay in memory as long as the unit is switched to READ mode. This is very useful as it allows you to use the unit away from the PC and then retrieve the waveform at a later date.

As discussed later, the DSOA's maximum sampling rate of around 600ks/s and its use of real-time sampling limits its effective signal bandwidth to about 60kHz. While modest by modern analog CRO standards, this is still more than adequate for many applications — including virtually all audio work.

Circuit operation

The heart of the DSOA is the 8-bit ADC0820 analog to digital converter chip. This is the fastest standard range 08xx ADC available, and can complete a full 8-bit conversion in as little as 1.5us by using a 4-bit modified 'flash conversion' technique (see box). It also has a built-in sample and hold function, which captures and stores the incoming voltage while the conversion takes place.

There are actually two versions of the 0820 chip. The ADC0820B is accurate to +/-0.5 LSB, but the more common ADC0820C is accurate to +/-1 LSB. However both will give nearly identical results in this circuit.



A look inside the author's prototype adaptor, housed in a readily available utility box. The PC board pictured is slightly different from the final pattern, but should still be useful as a guide to assembly.

The ADC0820 chip is readily available from suppliers such as Rod Irving Electronics and Geoff Wood Electronics, and costs about $20. This is 'dirt cheap' compared to most others. It also allows for a very simple circuit configuration — hence the decision to use it over other fast ADC's, such as successive-approximation and full 8-bit flash types.

Despite the apparent complexity of the circuit, the operation is really quite simple — thanks to the ADC0820. When switch S1 is in the store position and the reset button has been pressed, the D-type latch made from IC8a is reset and the Ready LED (LED1) will be lit. The RAM address counters IC1 and IC2 are also reset, so that their outputs provide the address of the RAM's first 8-bit storage cell.

IC8a then waits for a trigger pulse, from either the manual Start button S4 or the level triggering comparator IC7a. Note that the analog input signal enters via SK1, passes through input attenuator pot VR1 and AC/DC coupling switch S2, and then via R14 to both IC7a and input buffer IC7b — which feeds it to the ADC chip IC5. Diodes D2 and D3 are used to limit the input voltage swing to prevent damage to either half of IC7.

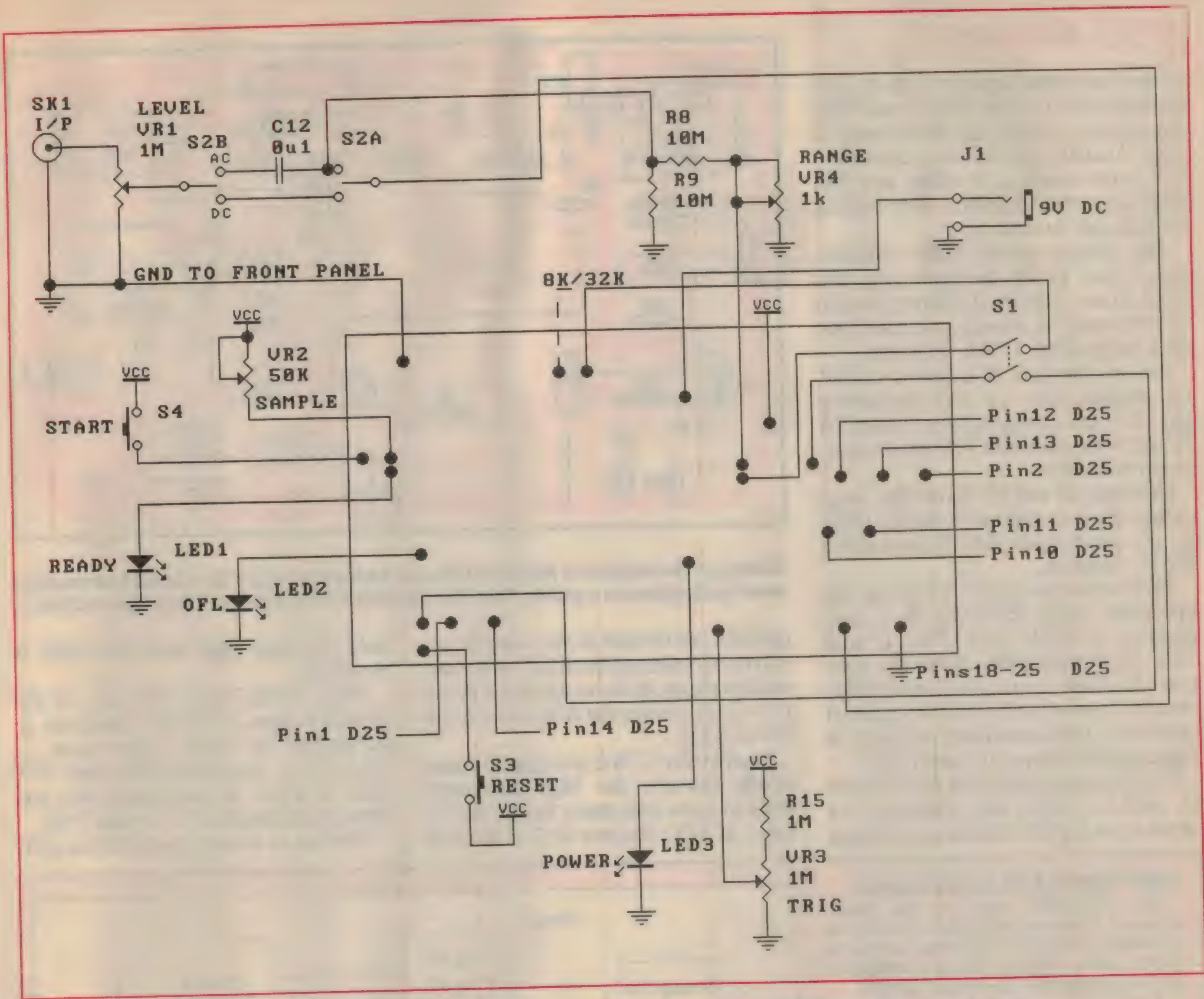
Once the latch is triggered, the 7555 sample rate clock (IC6) is enabled and will start to oscillate, at a frequency determined by VR2. This gives IC6 a sampling rate range of approximately 15kHz to 600kHz, with the value of 50k shown.

(If desired, VR2 can be increased in value to 1M to give a total sample time for 32K samples of about 30 seconds — which is useful for sampling slowly changing signals. If a still longer sampling time is required then C13 can be increased, but the clock output signal from pin 3 should not stay low for greater than 50us.)

The negative edge of the sampling clock signal from IC6 pin 3 is fed to the Ready input of IC5. This starts the A-D conversion cycle, which will take about 1.5us.

The ADC now takes a sample of the input voltage at pin 1. Inside the chip the input is compared with the reference voltage at pin 12, and a corresponding 8-bit code produced on output pins D0-D7.

At the end of conversion, pin 9 of IC5 goes low. As this pin is connected to the Write-bar input (pin 27) of the 62256 RAM chip IC3, this causes the data to be written into the first address in the RAM, as directed by address counters



Here's a diagram showing all of the connections between the PC board and the rest of the components.

IC1 and IC2. The signal from pin 9 of IC5 is also fed to IC9a, connected as an inverting OR gate which drives the clock inputs of IC1 and IC2. As a result, the address counters are also incremented, to change the RAM to its next address. That's the end of the basic conversion cycle (simple, huh!).

The same process is now repeated, until the RAM address counter reaches 32,768 — where pin 8 of IC2b goes high. As this pin is connected to the Chip Select input (pin 13) of the ADC, this stops any further sampling and in turn stops the incrementing pulses from pin 9 of the ADC. A set of 32,768 sequential 8-bit samples of the input waveform are now stored in the RAM.

If at any time during this sampling the input exceeds the reference voltage, then pin 18 of the ADC goes low until the input drops back. This will trigger the latch IC8b, which lights the overflow LED (LED2).

If you wish to use a 6264 RAM instead of the 62256, just remove link 1 and move S1b to pin 10 of IC2b instead of pin 8. This will stop the address counter at 8192 instead of 32,768 and everything works just as before — except that only 8192 samples will be taken.

Read mode

When S1 is switched to the READ position, this disables the ADC chip completely and sets its data bus pins (DB0-7) to a tri-state or open-circuited condition. The RAM will now be permanently in read mode, due to pullup resistor R4 on its pin 27.

The PC can now take over control of the RAM, being able to reset the address counters via IC9b and pin 14 of the DB25 connector, and also increment the counters via IC9a and pin 1 of the DB25. This allows the DSOA support software in the PC to read the data out from each location in RAM into the PC, process it and display it on the screen.

Unfortunately the PC's normal parallel printer port only has five input lines, which is not enough to read in all eight bits from each RAM address at once — although some ports do allow you to force data back into the output data lines, but that's another story! So we have to read in each sample as two separate four-bit 'nibbles'...

This is done with the 74HC157 (IC4), a quad two-input multiplexer which reads all eight bits from the data bus and provides either the lower four bits D0-D3 or the upper four D4-D7, as selected by pin 1 — controlled by the PC via DB25 pin 2. Simple!

So basically the PC software first resets the address counter, selects the lower nibble and reads it, selects the high nibble and reads it, then increments the counter. Then it reads the two nibbles for that address, in turn, and incre-

ments the counter again, and so on. This continues until all the data is read from the memory, or you tell the software to stop. Actually the software employs a few extra routines, to make sure that there are minimal errors when reading the data, due to noise etc.

The voltage on the ADC reference pins 11 and 12 sets the input range that the A-D can convert. It does not have to be referenced to ground, so it can be set for a range of say 1V-4V, if desired.

But in this case it is set to 0-2.5V, by earthing pin 11 and connecting pin 12 to the voltage divider formed by R7 and VR4, and with VR4 set for maximum resistance.

Resistors R8 and R9 divide this range voltage by two, to provide the DC offset for the signal input when S2 is switched for AC coupling.

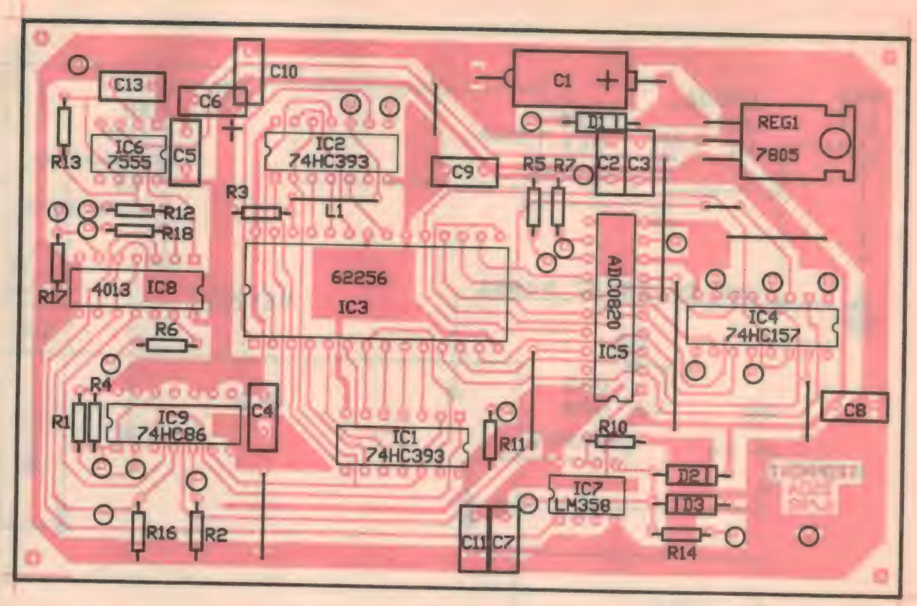
This means that on the AC setting, the maximum input sensitivity is a symmetrical +/-1.25V peak. This is with VR1 set to maximum. In the DC position of S2 the input is of course referenced to ground, and with VR1 again at maximum the instrument responds to input signals between 0V and +2.5V.

In both cases input level pot VR1 can be used to reduce the sensitivity, for larger input signals. Similarly the Range pot VR4 can be used to *increase* the sensitivity, by reducing the ADC's reference voltage range; however this has a penalty — it also makes the ADC more sensitive to noise.

Input buffer IC7b is a voltage follower which converts the high impedance input to a low impedance for driving the input of IC5. Resistor R10 is used to hold the input rigid while the ADC is sampling.

Most of the logic ICs are of the 74HCXX type, and these should not be substituted by other types such as 74LSXX — particularly IC4 and IC9. Also it is *not* recommended that you substitute a standard 555 for the 7555.

The lead to connect the DSOA to a PC



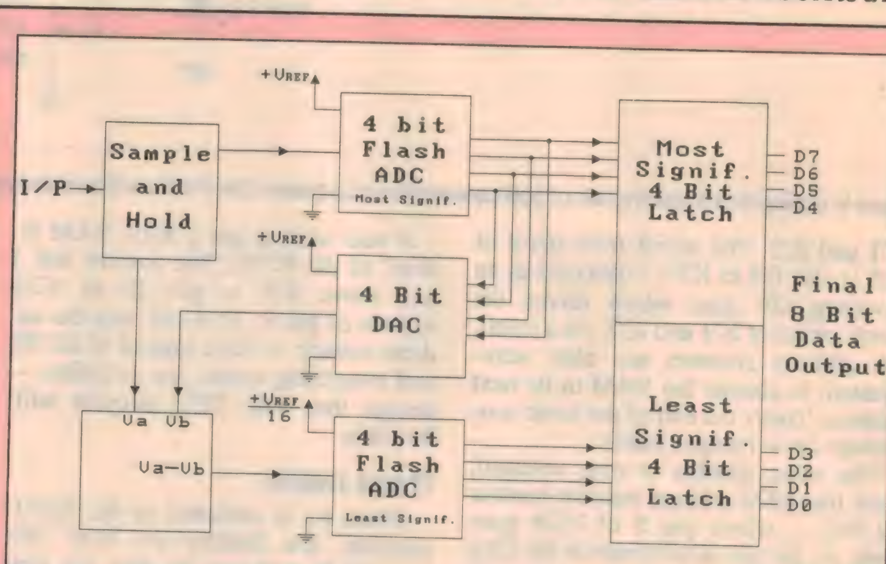
Wiring up the adaptor's PC board should be fairly straight forward if you use this overlay diagram as a guide. Take care with the orientation of the polarised parts.

Half-flash A/D conversion

The ADC0820 used in this project achieves its conversion speed by using the so-called 'half flash' conversion technique. As the name suggests, this is a variation of the well known flash conversion method.

Full flash converters can get quite complex, as they require 2^n comparators and resistors — where 'n' is number of bits in the digital sample. So an 8-bit full flash ADC requires 256 comparators, resistors and decoding logic, all on a single chip. This is why they are so expensive to manufacture (and to buy!). But what they do offer is the fastest ADC speed available.

The 'half flash' technique uses dual flash converters, which each require only half the total number of bits. Therefore an 8-bit ADC like the 0820 requires two four-bit flash converters, a 4-bit DAC and an 8-bit latch, as can be seen in the block diagram. That makes it a lot simpler to manufacture, and gives it a speed capability somewhere between full flash and successive approximation.



As a 4-bit flash conversion only requires 16 comparators, the ADC0820 only needs 32 comparators and resistors as opposed to 256 in a full 8-bit flash ADC. This lowers the chip complexity and cost significantly.

The basic principle of operation is as follows. The most significant 4-bit ADC converts the voltage from the sample and hold, and produces a corresponding 4-bit digital code.

This 4-bit nibble, representing a 'low resolution' sample of the input voltage, is put into the most significant latch. At the same time, it is converted back into an analog voltage by the DAC.

This 'rough approximation' voltage is then subtracted from the sampled input voltage, producing an error or difference signal.

This difference voltage is then converted into another 4-bit digital value by the least significant flash ADC, which is referenced to 1/16th of the reference voltage used by the first. This produces a second nibble, which is then put into the least significant latch. All of this gives exactly the same result as a full 8-bit full flash conversion, but it takes a little longer.

One particular advantage of this technique is that if you require a faster speed and only need 4-bit resolution, then the most significant latch can be read out straight away — as it acts just like a normal 4-bit flash.

So with this kind of ADC you have the option of selecting between a fast 4-bit conversion or a slower 8-bit version for higher resolution.

is of the simple 'straight though' variety, with pin 1 connecting to pin 1 and so on. It does not really have to be shielded (although this will help), as the software takes care of most noise. Ideally an unshielded lead should be kept under two metres in length.

Power for the complete DSOA can be supplied by a 9V DC plugpack, or any DC supply of greater than 8V. The 7805 regulator IC does not require a heatsink as it hardly gets warm. The total current consumption is under 50mA.

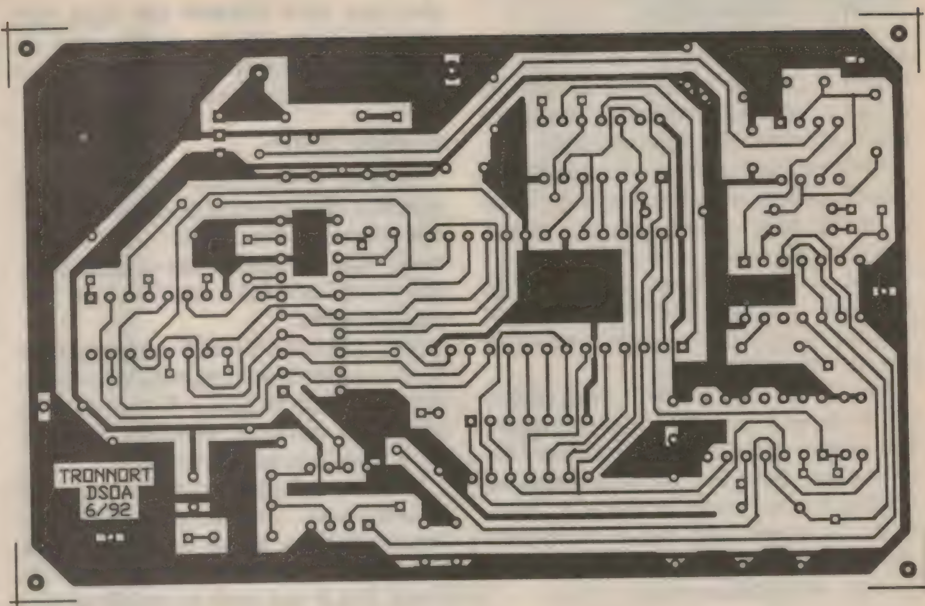
Limitations

Nyquist's sampling theorem says that any signal that is greater than half the sampling frequency cannot be faithfully reproduced.

However for sampling and reproduction of a complex waveform, which has significant harmonic content, the sampling frequency needs to be at least 10 times the input frequency. This is the situation which applies in the case of a DSO, and this DSOA is no exception.

The maximum sampling rate of the DSOA is determined by the ADC chip, which has a rated maximum of at least 600ks/s — giving a signal bandwidth of around 60kHz. But each chip will be slightly different, and many will be capable of going higher than this figure.

To push the bandwidth of your chip to its limit, you need to reduce resistor R12 which sets the maximum sampling clock rate. You can reduce it to 680Ω, or even lower. Once the maximum for your ADC has been exceeded, the effect on the display is quite noticeable as the waveform becomes very distorted.

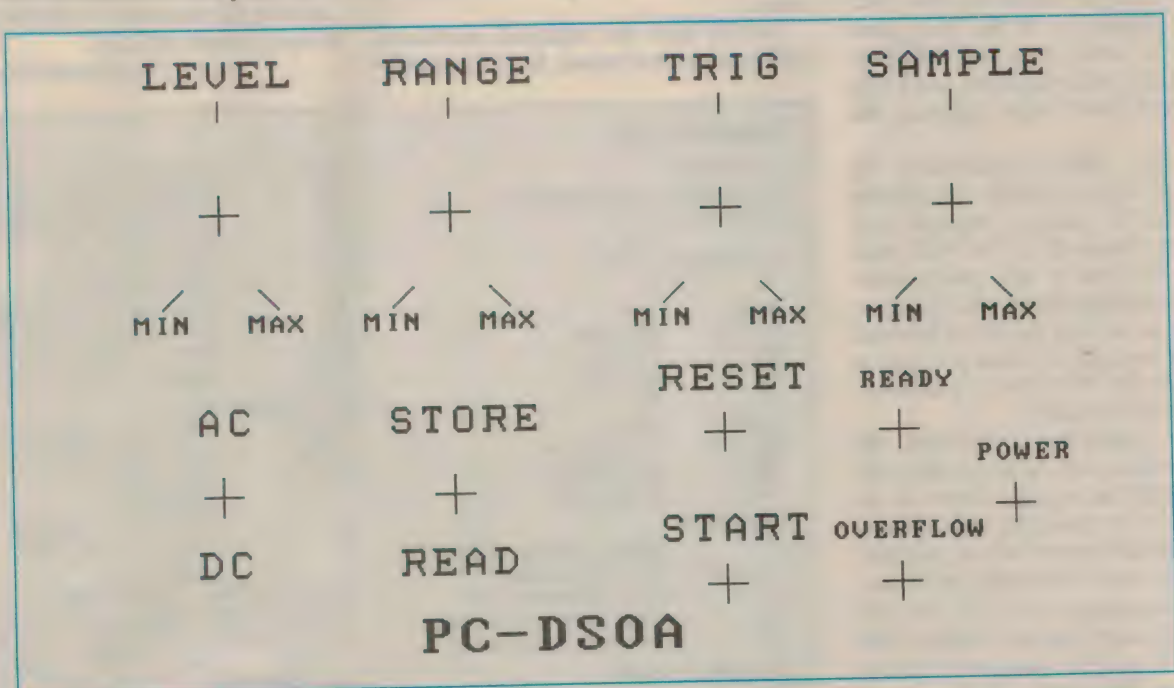


For those who like to etch their own PC board, here is the artwork, reproduced actual size.

You may in any case need to adjust the value of R12 one preferred value either way, depending on the exact value of C13.

In practical use the maximum sampling rate is not as important as the input slew rate. For the ADC0820 chip itself, this is quoted as 0.1V/us for full 8-bit resolution, although this isn't very important due to the internal sample and hold. The real problem lies in IC7b, the input voltage follower. This chip has no quoted spec for slew rate, but measures about 0.2V/us. So don't try and sample a 2V square wave at 50kHz, because the poor thing just can't keep up! This could have been overcome by using a faster voltage follower, but they are either hard to get or require dual supplies — which wasn't worth the hassle.

Basically the DSOA works best in the



And here is the author's artwork for the adaptor front panel, which can also be used as a drilling template.

audio range — i.e., up to 20kHz, although it can operate at over double that if you're not too interested in resolution and exact waveform reproduction.

Another limitation of the LM358 is that the output voltage can only go down to about 4mV above ground, with a single supply (only — WOW!).

This is fine with an input voltage swing of 2.5V, as each ADC level step is 2.5/256 = 9.8mV — much larger than the 4mV clipping point.

But if the input signal swing drops below about 1 volt peak, and you adjust the Range pot VR4 to increase the resolution, then the clipping becomes evident at the bottom of the waveform. Still, this is generally not of much concern as the rest of the waveform is usually more important anyway.

Construction

All of the components, with the exception of the pots, switches, LEDs, and sockets are mounted on a single PCB that fits neatly inside a standard size jiffy box. IC sockets are highly recommended for all ICs, particularly the relatively expensive ADC and RAM chips.

A shielded metal case would be preferable, but a plastic jiffy box with a grounded metal front panel works fine. It also looks heaps better, and is easier to cut out. The easiest way to ground the front panel is to use a solder lug under one the switches.

Start construction by drilling the front panel, box and the cutout for the DB25 socket. A photocopy of the front panel label can be used as a drill template. Mount all the pots, switches and LEDs on the front panel after applying the label.

Begin the PCB construction by mounting all the low profile components such as the IC sockets, resistors and links. Next mount all of the PCB pins, and then the rest of the components. Watch the orientation of the polarised capacitors, as well as the IC sockets and LEDs. The regulator IC does not have to be bolted to the PCB, but it makes the board look much neater.

Once the board has been wired, the rest of the wiring can be made using the wiring diagram as a guide. None of the wiring has to be shielded, although the leads should be kept as short as possible, once again to avoid any noise problems.

Before plugging in any ICs, the unit should be powered up and checked that there is +5V going to the correct pin of each socket. Then turn off the power, and fit all the ICs — making sure that they are each inserted the right way around. Your DSOA should then be complete and ready for use, after screwing the front panel to the case.

In operation

To store a waveform, the DSOA must either be disconnected from the PC, or if it is connected the software must be running. This is to ensure the external reset and clock lines don't interfere with normal operation.

First select the STORE mode and then set the trigger level required (VR3 varies the level from 0-2.5V). If you wish to trigger the sampling manually, then set the trigger level to maximum.

If the input frequency and voltage can be anticipated, then the attenuation and sample rate can be set so that a decent waveshape is recorded on the first attempt. But if you wish to sample an unknown waveform, then it may take a few attempts and adjustment of the attenuation and sample rate to get a good result.

The best way to sample an unknown waveform is to set all the controls to maximum, press the reset button and start sampling with the manual start button or trigger control. If the overflow LED lights, then reduce the input Level control setting and try again.

Try to keep the Range control near maximum, as this will give a better quality waveform (i.e., minimum noise and distortion). But if the input swing is less than 1 volt, then the Range control may have to be turned down significantly to keep the waveform close to full scale.

In this case the replayed waveform will have a bit of noise, but it is usually under 10 LSB's in amplitude — which is not all that bad. By using the combination of the Level and Range controls, it is possible to store an input signal ranging from a few hundred millivolts to tens of volts full scale. A x10 CRO probe can also be used to divide large signals by a further factor of 10.

After the unit is triggered and the Ready LED turns off, wait a few seconds for the sampling and then switch to READ mode. If a nonvolatile or battery-backed RAM is used, then the unit can be safely switched off and transported. The waveform can now be read into the PC for analysis.

Try to keep the unit away from electromagnetic fields such as the computer monitor when sampling, or noise can be introduced onto the waveform.

The software

The DSOA support software is the key to the whole project, by providing the means to read the waveform from the RAM in the DSOA and display it on the screen.

When the program is loaded it checks for the type of graphics adapter installed and configures itself accordingly. It will work with Hercules/CGA/EGA/VGA graphics cards, but Hercules requires MSHERC.COM to be loaded first.

A CGA is not recommended, because with a vertical resolution of only 200 pixels, the 256 points on a waveform are commpressed down to about 150 pixels on the screen. But it still gives quite acceptable results. With any other type of adapter the waveform is displayed with at least 1 pixel per LSB.

Continued on page 95

PARTS LIST

Resistors

(All 1/4W 5% unless indicated)

R3,R4,R5,R14,R16	10k
R1,R6,R7,R11,R18	1k
R8,R9	10M
R10	680 ohms
R12	820 ohms
R13	220 ohms
R15	1M
R2,R17	100k
VR1,VR3	1M linear pot
VR2	50k linear pot
VR4	1k linear pot

Capacitors

C1	470uF 16VW electrolytic
C2,C10,C11	10uF 25V tantalum
C3-C9	0.1uF monolithic (x7)
C12	0.1uF metallised polyester
C13	1nF metallised polyester

Semiconductors

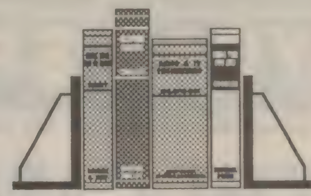
D1	1N4001 silicon
D2,D3	1N914 or 1N4148 silicon
IC1,2	74HC393 binary counter
IC3	62256 static RAM, 256Kb
IC4	74HC157 quad multiplexer
IC5	ADC0820 half-flash ADC
IC6	7555 CMOS timer
IC7	LM358 dual op amp
IC8	4013 dual D-type flipflop
IC9	74HC86 quad Ex-OR gate
REG1	7805 5V regulator (TO-220)
LED1-3	Red LED in panel-mount bezel

Miscellaneous

S1,S2	DPDT miniature toggle switch
S3,S4	SPST miniature pushbutton
SK1	BNC socket, single hole mount
J1	DC power input socket
J2	DB25 connector, male, panel mount

Plastic utility box, 150 x 90 x 50mm; PC board, 120 x 76mm code DSOA 6/92 nine DIL sockets — 2 x 8-pin, 3 x 14-pin, 1 x 16-pin, 1 x 20-pin, 1 x 28-pin; hookup wire; machine screws, nuts and spacers for PCB mounting; screws for mounting DB25 connector; solder, etc.

NEW BOOKS



Shortwave guide

PASSPORT TO WORLD BAND RADIO, 1993, edited by Lawrence Magne. Published by International Broadcasting Services. Soft cover, 255 x 180mm, 416 pages. ISBN 0-914941-40-2.

The latest edition of this popular annual follows its usual format to help you to get the most out of listening to broadcasts from all over the world: how to listen, what to listen with; and when and where to listen. It also lists recommended top shows for 1993 and its 20+ Top Signals, which would be a good starting point for beginners.

A special feature in the first section covers clocks for world band listeners, concentrating on those models with map displays. Such a map makes it very easy to determine, at a glance, conditions at the source of signals you are listening to — it is not always easy to convert local time to 'World time' (UTC). Another section tells how to choose a world band radio, with separate groupings for car models, portables and tabletop receivers. Prices, advantages and disadvantages are listed for each model.

'When to listen' covers prime time (evening) listening, grouped for convenience for people in North America, East Asia and the Pacific, Australasia, and Europe. A very comprehensive summary of all broadcasts is given in the 80 'Blue Pages' at the back of the book, listed in order of increasing frequency from 2310-25,940kHz and giving schedules, transmitter power, area targetted, etc.

In short, it contains a host of information which would be especially useful for a beginner to shortwave radio, as well as for the dedicated listener.

The review copy came from Craig Tyson, a WA contributing editor. It is available from all Dick Smith Electronics stores in Australia (Cat. No. B-2052, \$39.95), from Stewart Electronics in Victoria, and in NZ from Arthur Cushen, 212 Earn Street, Invercargill. (P.M.)

Handy data book

PRACTICAL ELECTRONICS HANDBOOK, third edition, by Ian R. Sinclair. Published by Butterworth-Heinemann, 1992. Soft cover, 215 x 138mm, 338 pages. ISBN 0-7506-0691-6. Recommended retail price \$49.95.

The aim of this book is to include most of the basic theory and practical reference information needed in electronics, together with brief explanations which are intended to serve as reminders rather than instructions. Unlike the normal data book, it is far more than collections of information with little or nothing in the way of explanation.

Chapters 1 and 2 deal with passive and active discrete components and their applications, while chapter 3 covers discrete circuits; chapters 4 and 5 deal with linear and digital ICs, and chapter 6 on microprocessors and uP systems.

Transferring digital data and digital-analog conversions are dealt with in chapters 7-8, while chapter 9 covers computer aids (for circuit analysis and PCB drawing, etc.), and finally chapter 10 deals with hardware components and practical work.

A huge amount of information is presented, with many illustrations, tables and worked mathematical examples where applicable (e.g., for Thevenin's theorem to illustrate passive component circuit analysis, and Boolean algebra for combining IC logic gates).

So, if you want to revise what a D-type flipflop is, or how to wire up a null modem, or some similar problem, then this book is an excellent reference.

The review copy came from Butterworth-Heinemann, PO Box 345, North Ryde 2113. It is available from technical bookshops. (P.M.)

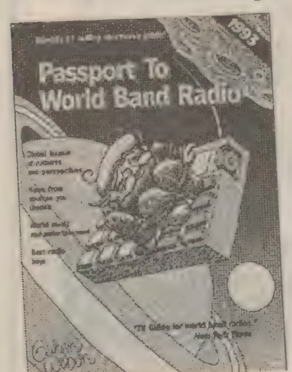
Amateur abstracts

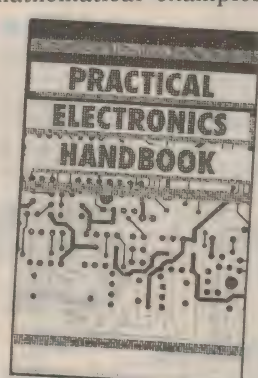
AMATEUR RADIO TECHNICAL ABSTRACTS, Volume 1, edited by Graham Thorton VK3IY. Published by Thornton Publishing, 1991. Hard covers, 215 x 160mm, 123 pages. ISSN 1036-3025. Price in Australia \$32.65 including postage.

Those readers who are also members of the WIA may be familiar with a column that Graham Thornton at one stage contributed regularly to *Amateur Radio*, with brief abstracts of technical articles relevant to the radio amateur, published in many of the world's radio and electronics magazines. This is the first volume in a planned series of books collecting and continuing these abstracts, and intended to form a valuable reference source — not only for individuals, but also for radio clubs and libraries. With all of the information being published nowadays in this field alone, such a work should be very useful indeed.

The publications covered include *Elektor Electronics*, *Everyday Electronics*, *Practical Wireless*, *Radio Communication* and *Sprat* (UK); *QEX*, *QST* and *73 Amateur Radio Today* (USA); *QST Canada*; *Radio ZS* (South Africa); and Australia's own *Amateur Radio* and *Electronics Australia*. There are almost 1000 separate abstracts, organised into 16 topic chapters, plus a glossary of acronyms and abbreviations, and cumulative 5-year author and subject indices.

All in all, a very handy reference work for anyone with a serious interest in the technical side of amateur radio and related areas. It's available from Thornton Publishing at PO Box 298, World Trade Centre, Melbourne 3005. (J.R.) ❖





JAYCAR SPECIALS FOR FEBRUARY

NEW CATALOGUE NEXT MONTH

240V-12V INVERTER 500 WATT - SAVE $100

Save a massive $100 on our 500 watt inverter.
Cat. MI-5050

WAS $499 NOW $399

SPEAKER CABLE PACK BARGAIN

5 metres of cable in Arista brand package. Diameter 14/0.14mm. Red/black.
Cat. WB-1700

ONLY $1

STOCK UP NOW!!!

75Ω COAX CABLE SELLOUT ★★★★★★★★★★

BARGAIN 1 - Benelec brand 0.65mm conductor - airspace PE dielectric, foil shield, 5mm OD sheath, brown in colour airspace 75Ω coax. Limited quantity.
Cat. WB-2002

100mt Roll $29.95

SAVE $5 ★★★★★★★★★★★

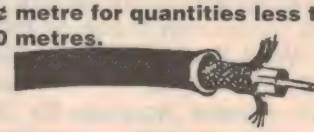
60¢ metre for quantities less than 100 metres.

BARGAIN 2

75Ω heavy duty white coax. Basically the same as our WB-2004 heavy duty coax which sells for $1 metre or $70 per 100 metre roll.
Specs: conductor solid 1/0.70mm. OD 7.3mm.
Cat. WB-2005

ONLY $35/100 metre roll

60¢ metre for quantities less than 100 metres.



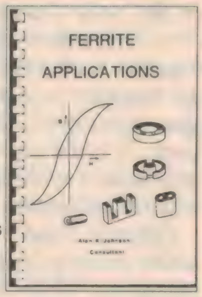
COMPUTER LEAD BARGAIN

Centronics plug to 34 pin edge connector, wired with flat cable. 2.4 metres long. Limited quantity.
Cat. PL-0878 **ONLY $5**

FERRITE MATERIAL & APPLICATIONS BOOK

This is one subject that is very difficult to find any information on. Magnetic cores are the foundation for transformers, inductors and chokes used in so many of our electronic projects. This book is intended to be used by persons who want to (or have to) work with ferrite materials, but are not well versed in magnetics or ferrites and cannot justify outside consultation. Some of the problems addressed are:- • How to select the right type of material
• How to identify an unknown material
• How to measure material properties and much more. Written in 1991 by A. K. Johnson. This book is due to arrive sometime in January - hopefully, the first half. Softcover, ringbinder. 82 pages 212 x 132mm.

Cat. BC-1125 **$18.95** ★★★★★★★★★★★★★



4 DIGIT LED DISPLAY - COM 6121

This display is common cathode and is mounted on a PC board with all connections along the bottom of the board. Display size is 72 x 19mm. PC board size is 92 x 25mm. Digit height is 16mm. Cat. ZD-1860

WERE $4.95 ea NOW $2.95

PRO QUALITY INSTRUMENT CASE *SLASHED*

This box is the largest one in the range of 3. It has been used in countless kits, including test equipment, power supplies etc., etc., etc. Grey colour, with black plastic panels. Size 260(W) x 190(D) x 80(H)mm. Catalogue price is $20.95. We're overstocked. Stock up now at this crazy price.

Cat. HB-5910 **$12.95 ea SAVE $8** 10+ LESS 10% ★★★★★★★★★★★

METEX COMPUTER DMM SLASHED

See catalogue for full details.
Features: RS-232 computer interface, bargraph, frequency, transistor, logic, relative offset, 3.5 digit, 20 amp current, carry case, overload protector, data hold, min/max hold, diode and continuity, range selector beeper
Cat. QM-1450

WAS $209.50
FEBRUARY $169.50
SAVE A MASSIVE $40 ★★★★★★★★

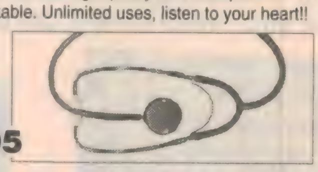
SOLDER LUG BARGAIN

These are slightly soiled, but nothing that a rub between the fingers won't fix. They are NOT rusty, and after a wipe will solder perfectly.

Normally $1.95 for 50
Cat. HM-1352
THESE - $1.50 for 100

STETHOSCOPE

Yes, that's right Jaycar now stocks a high quality stethoscope!! Its acoustic response is remarkable. Unlimited uses, listen to your heart!! Use with our blood pressure meter, even listen for nasty knocks in your cars engine. Japanese made.
Cat. QM-7255 **$19.95**



VINTAGE RADIO CALENDAR

First edition in full colour. Featuring a selection of Australia's most photogenic radios. A different radio each month.
Cat. BC-1195 **$18.95**
★★★★★★★★★★★

JAYCAR ELECTRONICS

HIGH QUALITY BOXES SLASHED

These boxes are made in high impact ABS plastic. The top and bottom sections separate and have a tongue and groove to ensure a perfect fit. They have a small removable section on each end which is dark grey in colour with the rest of the box dark grey. They are held together by threaded brass inserts and screws are supplied. There is also 4 threaded brass inserts on the base for holding PC cards.

SMALL Size 160(L) x 80(W) x 44(H)mm

Cat. HB-6051 **WAS $15.95 NOW $9.95 SAVE $6**

MEDIUM Size 160(L) x 80(W) x 670(H)mm

Cat. HB-6052 **WAS $16.95 NOW $10.95 SAVE $6**

LARGE Size 197(L) x 110(W) x 86(H)mm

Cat. HB-6056 **WAS $21.95 NOW $14.95 SAVE $7**

MINI SPEAKER BARGAIN

Limited quantity - 2 3/4" x 1 1/2" 8 ohm 500mW.
Cat. AS-3022

WAS $4.95 NOW $2 ea

MINSTREL 2 WAY CROSSOVERS

Ref: Silicon Chip Feb 1989
These are high quality two-way crossovers that were used in our Minstrel speaker kit. Power handling is 60Wrms. Crossover frequency 3kHz. Fully built.
Cat. CX-2610
SPECIAL PRICE TO CLEAR STOCKS

NORMALLY $39 ea

THEN $29.50 ea

NOW $20 ea - very limited quantity

ELECTRODYNAMIC STEREO HEADPHONES - REDUCED

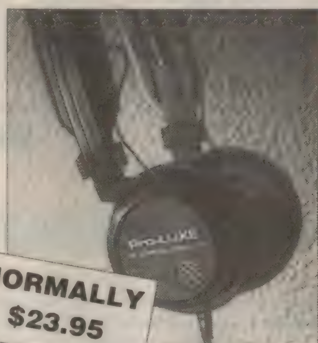
Designed for CD's. Comfortable and lightweight. Compatible with all stereo equipment.

Frequency Range	20-16kHz
Impedance	32Ω ±3%
Max Input Power	100mW
Sensitivity	105dB SPL @ 1kHz
Length of Cord	9 feet long cord ±3%
Adaptor Plug	3.5mm to 6.5mm type

Cat. AA-2010

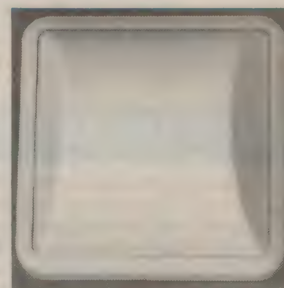
NOW $16.95 SAVE A MASSIVE $7

NORMALLY $23.95



The Best Passive Infra-Red Detector We've Ever Seen

We have made yet another scoop purchase of an extremely high quality 'National' (Panasonic) Japanese PIR. Quite frankly we have never seen a PIR built as well. To give you an example, the first amplifier stage from the Pyroelectric element is actually built right behind the element and housed in a shielded box. This maximises the signal to noise ratio and helps reduce false triggering. Three lens configurations are offered:



1) Ceiling mount, 360° coverage. This is the only unit that we know that can do this.
Cat LA-5028

WAS **$149.50 NOW $59.50**

2) Wall/ceiling mount long range. Will detect intruders up to 30 meters away, with a narrow beam angle. Ideal for hallways, looking down rows of shelving, etc.
Cat LA-5030

WAS **$99 NOW $59.50**

Each unit comes with comprehensive instructions, NC Tamper Circuit, N.O./N.C. alarm output. Power requirement 6-18V DC or AC. Range sensitivity is adjustable which is in keeping with the professionalism of the unit. These units were used by professional installers for major building securities. They are not cheap 'toy' PIR's.

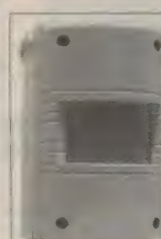
FULL FEATURE TELEPHONE ANSWERING SYSTEM WITH IN-BUILT TELEPHONE

Features: • Tactile rubber keyboard • Telephone will work even if the power fails • Hearing aid compatible handset • 9 memory dialler with last number redial • Austel approved.
Cat. YT-7035

WAS $169 NOW $139 SAVE $30

NIGHT SECURITY SENSOR

This brilliant product uses a built-in passive infra-red (PIR) detector that reacts instantly to body heat, and activates a light when a person approaches your home. The light automatically turns off when the person leaves. The sensor will switch up to 600 watts and when set will only operate at night. After triggered, the lights can be adjusted to remain on anywhere between 5 seconds and 10 minutes.
See catalogue for full details. Cat. LA-5130



WAS $99 NOW $69 SAVE $30

TERMINATOR PIR

End of model runout. See catalogue for full details.
Cat. LA-5018

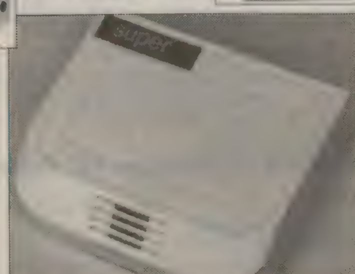
WAS $79 NOW $59 SAVE $20

NEW 1992 EDITION - MOTOROLA FAST AND LS TTL DATA

The ultimate book on 74LS and 74F series IC's. Chapters include: selection information, circuit characteristics, design considerations, FAST data sheets, LS data sheets, reliability data, package information including surface mount.
700 pages, softcover, size 232 x 177mm

Cat. BM-4505 **$24.95**

GLASS BREAK DETECTOR



At last, a reasonably priced, quality Glass Break Detector. The LA-5195 is an acoustic glassbreak detector designed to listen for specific sonic frequencies of breaking glass. It's equipped with multi-level discriminating circuitry to maximise its response and minimise its response to normal environmental noises. It will not alarm in response to a slamming door, or even a tap on the case. Also incorporated is a sensitivity adjustment potentiometer. It will cover a room up to 10m x 10m and is priced well below others of the same quality.

Specifications
• Voltage input 6-26 V DC • Supply Ripple 1V P-P max • Current 20mA max (12V DC) • Operating Temp. -10 to +50°C • Alarm Duration 1 second • Coverage Max Sensitivity 10m x 10m (35' x 35') Min Sensitivity 60cm x 60cm (2' x 2') • Colour White • Output Terminals N/C • Size 75(w) x 63(h) x 21(d)mm

Cat. LA-5195 **$79.95**

WATERPROOF 'BOPLA' WALL MOUNTING BOXES

Available in three sizes. These are TOP quality boxes. They are ideal for housing timers, controllers, alarms, etc, outdoors. They are made from high impact glass reinforced polycarbonate with a hinged transparent door. They are divided into two separate sections, thereby providing a suitable means of interfacing electronic equipment with external wiring. The upper section has integral PCB slots moulded into 4 slides, also fitted to the back are tapped inserted (M3) to allow the mounting of a panel or board, which may be extended downwards into the lower section for interfacing purposes. The lower section has knockouts for conduits or cable in the rear and bottom faces. Both the opening door and the removable bottom front panel have a rubber gasket to ensure a waterproof seal. Colour is light grey. Operating temperature range -40°C to +80°C. Another Jaycar surplus deal which we can offer you these high quality boxes at well below 1/4 what other suppliers are asking. Three sizes available.

Dimensions (mm):

	Width	Total height	Door height	Depth at door	Depth under door
Small size	162	154	96	115	47
Medium size	210	179	116	98	46
Large size	255	212	146	129	55

JAYCAR PRICES

SMALL SIZE **$14.95** 1-9 pcs Cat HB-6040

MEDIUM SIZE **$19.95** 1-9 pcs Cat HB-6041

LARGE SIZE **$24.95** 1-9 pcs Cat HB-6042

Quantity buyers • 10+ less 10% off above prices • 20+ less 20% off above prices

Our opposition (the ones with the really thick

SLASHED EVEN FURTHER OVER 50% OFF OUR NORMAL PRICES

31/2" AND 51/4" PRE-FORMATTED HIGH DENSITY DISKS

NEW FROM JAYCAR

Jaycar is proud to introduce to its range two more high quality disks pre-formatted to IBM. Don't spend up to 30 minutes in formatting your disks when you can buy pre-formatted disks for not much more money than our standard disks!

51/4" DSHD PRE-FORMATTED

Cat. XC-4733 **ONLY $11.95** pkt of 10

31/2" DSHD PRE-FORMATTED

Cat. XC-4739 **ONLY $16.95** pkt of 10

Both disks carry a lifetime guarantee

LOW COST MAINS PROTECTION FOR COMPUTERS, MONITORS, PRINTERS, FAX'S, PHOTOCOPIERS, ETC.

IEC IN-LINE MAINS FILTER

The Jaycar MS4000 will provide a quick, low cost means of SURGE and SPIKE protection for computers, monitors, printers, fax's, photocopiers, plus a wide range of other micro processor products. It consists of a lead with IEC plug to 240V plug, two metres long with the mains filter in-line.

Technical Specifications

Lead 240V plug to IEC plug **Cable** 2 metres long **Material** Flame retardant ABS case **Voltage** 240V 50Hz **Max Current** 10A 2300 watts **Total Energy Rating** 40 Joule 8/20µS **Filtering** Surges, spikes **Clamping** 275V rms **Peak Energy Diverter** 2,500 amps **Protection Type** PN, PE, NE **Approved** Aust Safety Standards AS3100, AS3105 Cat. MS-4000

ONLY $27.95

MINI VACUUM ATTACHMENT KIT

This unique product simply plugs into the end of your existing household vacuum cleaner hose and away you go. Supplied with: • an adaptor to suit all vacuum cleaner hoses • 1 x 80cm clear flexible tubing • 1 x straight and curved extension pipe • 1 x oval brush • 1 x round brush • 1 x crevice tool. Great for cleaning computers, typewriters, office machines, stereo and video equipment, etc.

Cat. XV-5060 **$19.95**

BACK IN STOCK

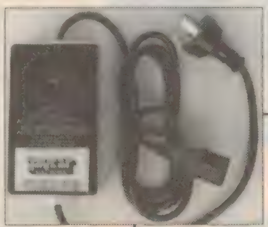
TWO OUTLET IN-LINE MAINS FILTER

NEW FROM JAYCAR

This is the big brother to the MS4000. The MS4002 features a large 4.5kA, 120 Joule 8/20µS transient protection. The unit consists of an IEC mains lead with a box mounted in-line. Also included in this box is a 2nd 3 pin outlet. The MS4002 combines the existing mains power lead of your computer with a high grade power filter. It also incorporates one extra output receptacle to conviently connect printers or other peripherals to the same protection circuit. With the MS4002 fitted to your computer system you can • reduce service calls by up to 95% • Increase hardware life • reduce maintenance costs • reduce down time.

Technical Specifications

Voltage 240V AC 50Hz **Max Current** 10A 2400 watts **Input** 3 pin 240V plug **Output -2** 1 x 3 pin 240V, 1 x IEC **Inrush** 10 times the continuous rating **Earth Leakage** 0.6mA **Efficiency** 95% at full load **Duty Cycle** Continuous **Transient Response** <25A5 **Energy Absorption** 120J 8/20µS **Peak Clamping** 275V rms **Peak Surge** 4.5kA **Approval** Aust Safety Standard AS3100, AS3105



Cat. MS-4002 **$79.95**

JAYCAR GAS!

We now have our own brand Butane gas suitable for every gas soldering iron including our new Hot-Sol range. And the good news is that, because we've got our own brand and cut out the middleman WE CAN REDUCE THE PRICE.

Can size 150g.

Cat. NA-1020 **WAS $7.50**

NOW $5.95

SAVE $1.55

SURPLUS STOCK

Jaycar will purchase your prime quality surplus stock, components & equipment.

CALL MARK HARRIS OR BRUCE ROUTLEY ON (02) 743 5222 TODAY!

NEW KIT DIESEL SOUND SIMULATOR

Ref: SC December 1992

Cat. KC-5126 **$12.95**

★★★★★★★★★★★★

BECOME A JAYCAR DEALER

Contact our wholesale Department on (02) 743 5222

BUY IN BULK AND SAVE

HIGH POWER SUBWOOFER KIT

See Electronics Australia January 1993

Build a 200W rms subwoofer. After the June subwoofer article which featured our 8" subwoofer, EA was beseiged with requests for a higher power unit. They have used our Re/Sponse 12" driver and we have had cabinet kits made to suit.

SPEAKER Re/Sponse 12" driver Cat. CW-2145

$199 ★★★★★★★★★★★

CABINET KIT

The cabinet is not cheap, but we found that there is an enormous amount of work for the home constructor to line up all the wood, drill and screw. Our cabinet kit is made from 18mm MDF customwood, as recommended in the article. There are 64 holes pre-drilled to fix the 32 x 50mm screws supplied and needed for strong assembly. The baffle has been routed and the T nut sockets are in place to mount the driver. There is a 50mm round hole to mount the rear terminal which is supplied. The MDF customwood is supplied in a natural state with a view to painting it. ★★★★★★★★★★★★★★★★★★★★

Cat. CS-2485 **$189**

LOW COST INDUCTANCE ADAPTOR KIT FOR DMM's

Ref: EA December 1992

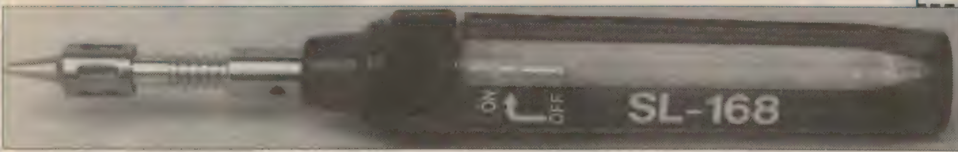
Measuring the inductance of wire-wound components has not been easy until now, but here's a handy adaptor unit which allows the job to be done with a standard digital multimeter. Operating from a single 9V battery and will measure virtually any of the inductances used in audio and similar circuitry with values in the micro Henry - milli Henry range. Kit includes PCB, case, all components. 9V battery required Cat. SB-2370.

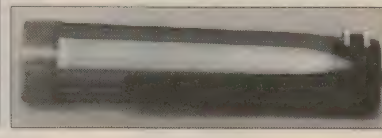
Cat. KA-1746 **$39.95**

HOT-SOL GAS SOLDERING IRONS

NEW FROM JAYCAR

DISTRIBUTORS WANTED





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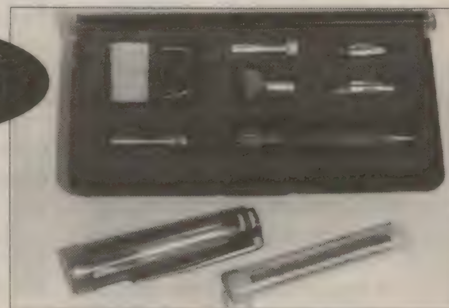

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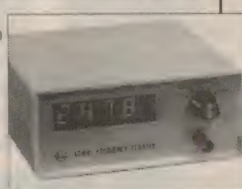

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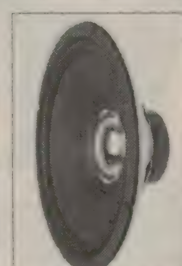

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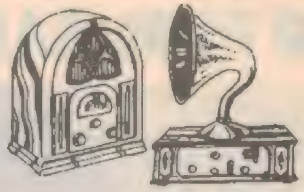
Vintage Radio

by PETER LANKSHEAR



Displaying your vintage equipment

The treasure that you triumphantly brought home has been lovingly repaired, its gleam restored and it is playing again. But *now* what are you going to do with it?

With the first two or three receivers, there is usually no problem. Assuming that the lady of the house is tolerant, a mantel receiver can be put to work in the living room, while a compact set can earn its keep substituting for the 'tranny' in the kitchen or perhaps can be used as the bedside radio.

Similarly a handsome console may be acceptable in the lounge room. But soon there comes a definite limit to the number of vintage radio receivers that the average household can absorb. Even a small number of wooden cabinets can occupy a surprising amount of space...

In spite of all the best intentions to limit the number of acquisitions, the nature of the collecting virus being what it is, most vintage radio enthusiasts eventually come to the stage when they have to take serious stock of where their treasures are to be stored and consider what they want to do with their collection — just store it, or display the items as well.

Most of us want to show our collections off to their best advantage. After all, why bother to refurbish radios just to hide them away? As they are meant to be seen, admired, discussed and played, they have to be accessible. Furthermore the display area must be secure, clean and dry — and as anyone who has experienced their activities will agree, rodent free! The results of a family of mice living in a chassis are most unpleasant, and some of the damage is irreversible.

Lucky indeed is the collector who has a room dedicated to his hobby; but many do not have this luxury. Older houses often have a generous hallway, which has sufficient width to accommodate a reasonable display without disrupting normal traffic. Fig.2 shows a good example. There may be other locations, such as a high shelf (as in Fig.4) which can be used to house a few sets without too much domestic discomfort.

An essential requirement for any vintage radio enthusiast is some sort of workshop facility, both woodworking and electronic, and often this has to be integral with the display. Provided that they are dry, basements can be used successfully, but restricted headroom or access can be problems. Similarly, secure outhouses and sheds can often be adapted for displays.

One popular area which often doubles as the workshop is the garage. This has the advantage of flexibility, in that space normally occupied by the car can temporarily provide extra room for workshop activities. Garage walls can be used for display areas, and more than one enthusiast has changed to a smaller car to gain more space!

Fig.1: This is definitely NOT the best way to display a collection, with items simply piled on each other...

Fig.2: A good example of a much better approach. Careful planning of shelf positioning can help in accommodating a comparatively large number of receivers in a small room or building, or even a wide passageway.

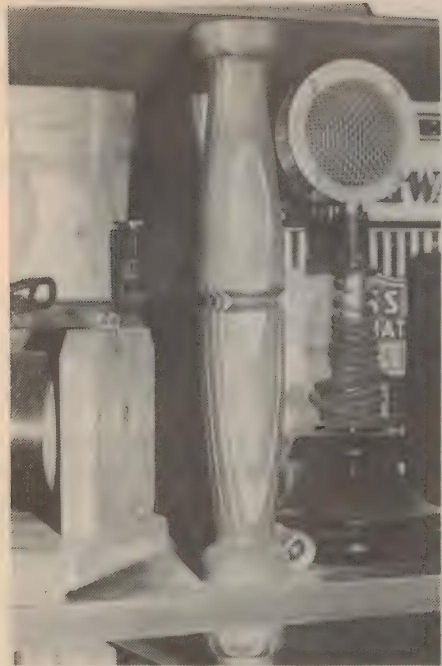


Fig.4 (above): A short high shelf can be used to good effect in an otherwise unused space — in this case featuring a group of 1933 Atwater Kent 'round tops'.

Fig.3 (left): Details of the turned pillars visible in Fig.2, supporting the shelves. Also visible is an elderly microphone.

Fig.5 (right): A closeup of the adjustable display fittings used in the shelf of Fig.4.

Provided there is room on the property, the serious collector can consider a 'kitset' shed. These are widely advertised, in a range of sizes and choice of windows and doors. They can be quickly assembled on a concrete pad and dismantled when no longer needed. Lined and fitted out with shelves, these buildings can be excellent and provide reasonably economic accommodation.

Displaying them

Having decided on the display area, how is it to be furnished? Unfortunately, conditions like that shown in Fig.1 are all too common. The basic rules of displaying are that the exhibits should be readily visible and safe from damage. Obviously, a pile on the floor is a recipe for disaster and hardly attractive.

The best techniques can be seen in major museums, with their well lit and uncluttered displays and plenty of documentation. Amateurs do not often have the space or resources to achieve this sort of excellence, but they can borrow ideas from the professionals.

For example, only console radios should be on the floor, and ideally with their tops clear. Smaller receivers can be on shelves, small stands or tables. Wall-mounted shelving is the most practical method for many situations, and varied spacing makes the most economic use of the available area.

Care is needed, though. Row upon orderly row of receivers can create the impression of a warehouse. This can be avoided to some extent by breaking up lines and staggering sizes and spacings. Posters or a group of components as in Fig.6 are a very valid part of a display and can be used effectively to provide some variation.

With shelving so important, some care in its selection is essential, but the precut type with fancy finishes can be expensive. Plain dressed timber is an obvious choice, but it must be well seasoned or warping can be a problem. As many older mantel cabinets are quite deep, shelves should be 300mm (12 inches) wide, and obtaining lengths of plain timber of sufficient width may be difficult. Unveneered 15mm particle board can be good value and is reasonably stable. A standard sheet can be cut to provide four shelves, 2.4 metres (8 feet) in length.

Weighty problem

There are several ways of supporting the shelves, but whatever method is used it must be strong and secure, for radios can be surprisingly heavy. A row of five medium sized receivers can weigh 70kg and for this sort of load, simple 'L' brackets as used for a laundry shelf are quite inadequate! Closely-spaced full width partitions such as were once common in bookshelf construction can provide adequate support, but they can have the annoying habit of being in the wrong place.

If you have access to a lathe, the system illustrated in Figs.2 and 3 is worth considering. The shelves are attached at the rear to battens, but at the front, turned pillars provide support. Projections at the ends of the pillars fit into holes in the shelves, providing a stable and decorative construction.

Adjustable shelving

Both of the methods described are quite effective, but have the disadvantage that the shelf spacing cannot be readily changed. Our requirements have a lot in common with retail stores, which need display shelving that is strong, decorative, adjustable and not too expensive. One of the most satisfactory and popular is the kind of modular system shown in Fig.5.

Components for such systems are competitively priced and obtainable from firms selling shop fittings. (*In Australia, many of the larger hardware stores also stock them — Editor*) A check in the trade section of the telephone directory will help track down a supplier.

The slotted aluminium supports are spaced vertically along a wall at suitable intervals, and bracket plates with matching lugs are inserted into the slots to provide the shelf positions — which can be

readily changed as required. Plastic bearer pads clip on to the upper surfaces of the brackets, and for extra security the shelves may be screwed to the pads.

Spacing between strips should be about 500mm, which on wooden framed walls will often suit stud spacing. Masonry bolts should be used for fastening to brick or concrete walls. If a single shelf is required as in Fig.4, short offcuts of strips can be used for bracket support.

An important aspect of vintage radio displaying is the requirement in most cases for receivers to be operational. This can create some problems in achieving tidy wiring. One advantage of the system just described is the availability of fastenings for holding vertical panels, which can be used for mounting power and aerial distribution boards. These can go a long way towards providing orderly wiring.

Do not permanently wire an aerial to several receivers. A limited number of broadcast band aerial coils with high impedance windings can be paralleled, but it only needs one receiver switched to shortwave to effectively short circuit the rest out. One solution is to install aerial sockets at strategic points, and connect receiver aerial leads as required.

Labelling

Ideas about labelling of exhibits vary. A museum display catering for the public must be adequately labelled, but in general terms. On the other hand, for a small group of receivers likely to be seen only by experts, labels are not essential. Many private collections are in this category, and the owner is on hand if a visitor needs an explanation.

There are times, however, when labels should be used. From time to time, private collectors are called on by various organisations to provide a display for an exhibition associated with a historic event or the like. These opportunities should be taken as a public relations exercise whenever possible, and they can be a valuable source of radios. Often people have an old set to give away, but are looking for a responsible recipient who is not going to immediately turn round and sell it.

Clear and concise labels should be used, and should answer the two questions most often asked by the public: 'How old is it?' and 'How many valves?'. Neat legible printing is of course essential, and computer graphics programs can be used for professional looking labels that will enhance any display. The author has made good use of the letterhead facility of the popular computer program 'Printshop'. Paste the printed paper on to a piece of cardboard, fitted with a triangular rear strut to provide a free-standing mounting.

Finally, a point of etiquette. An important part of the fun of vintage radio is visiting other collections. Most collectors welcome the fellowship and are pleased to host visitors, but please, give a warning of your visit. Murphy's Law says that an unexpected visitation will always be at the worst possible time, with the collection in disarray and the owner/collector up to the elbows in another restoration project! ❖

Fig.6: Groups of accessories can provide colourful breaks in rows of receivers. Eight different countries are represented in this collection of valve cartons.

Clubs & Societies

HISTORICAL RADIO SOCIETY OF AUSTRALIA: The Melbourne Branch meets at the South Camberwell Tennis Club, cnr Burke Road and Bickleigh Street, Glen Iris. The next meeting will be on February 18, at 7.30pm. Further details from J.R. Wales, PO Box 283, Mount Waverley 3149.

The HRSA's Sydney Branch will be meeting at the home of John & Janette McIlwaine, at Bateau Bay, on Saturday February 6. Further details from Branch Secretary Ron Langhans, phone (02) 674 2846 (AH).

AUSTRALASIAN TELEPHONE COLLECTORS SOCIETY: Meetings are held at 7.30pm on the third Friday of January, March, May, July, September and November, at the Pole Depot Neighbourhood Centre, 23 St Georges Road, Penshurst NSW. Membership enquiries should be directed to ATCS, PO Box 572, Baulkham Hills 2153.

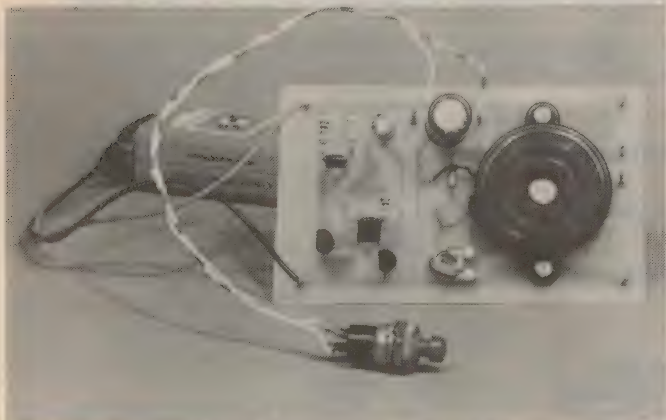
COLLECTORS CORNER: This feature has been temporarily suspended, due to a shortage of material...

Experimenting with Electronics

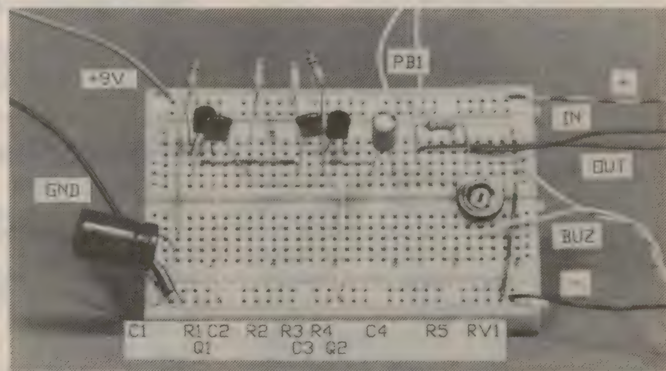
by PETER MURTAGH

A Morse code intercom

Long before 'wireless' dominated the communication field, messages were sent around the world via Morse code, along wires under the oceans and strung from telegraph poles. You can send messages in a similar fashion by building two of our 'telegraph stations' and linking them together to make a simple Morse code intercom. Using it will help you to learn the classic Morse code.



A tapping key is far preferable to the simple pushbutton shown in this photo for sending the Morse code.



You should have no trouble following this breadboard layout. The four leads at the right (+9V, OUT, IN, GND) connect via telephone-type cable to the second Morse code unit, which is the same as this.

The basis for our Morse code sender is once again the astable multivibrator. This month we have set up this familiar circuit to produce a frequency of about 3kHz, which is fed directly into a piezo transducer whenever the pushbutton PB1 is pressed. Because the transducer can respond immediately to the AC signal, we don't need an amplifier circuit — this greatly simplifies the circuitry required. (We used a DSE transducer, Cat L-7022, which cost $2.25.)

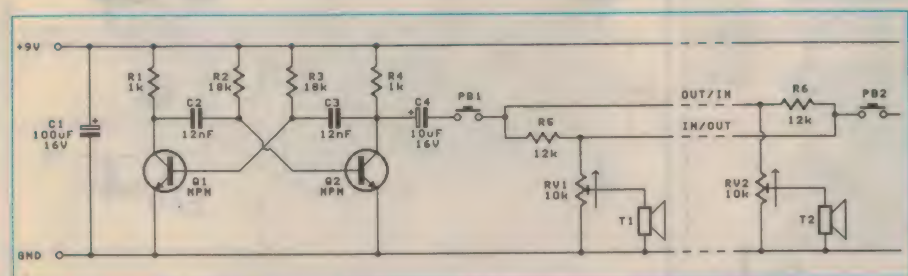
Of course the simplest design for our circuit would have the sender producing a series of pulses which are used to activate only the receiver's transducer. But hearing your own signals is a form of positive feedback, so we decided to send the signals to both transducers.

In order to prevent the feedback from becoming too distracting, the sender hears the signal at a lower volume than the receiver. To add this refinement only means one more resistor in the circuit, plus one extra interconnecting wire between the two units.

Since the setup already requires three wires (+9V, GND and signal) to link the two units, a fourth wire presents no problem if you use standard four-core telephone-type cable.

Construction

There are several ways of hooking up the two Morse code units, in terms of how many interconnecting wires, etc. It is possible to keep the wires down to two only, if you are prepared to use a separate battery at each end to power the units, and if you don't mind hearing your trans-



The circuit based around transistors Q2 and Q2 forms a 3kHz astable multivibrator. Pressing button PB1 sends bursts of the signal (the Morse code) to the other unit. Note that components R6, RV2 and PB2 are part of the second unit (duplicates of R5, RV1 and PB1 in the first). The signal coming OUT of unit 1 goes IN to unit 2, and vice versa.

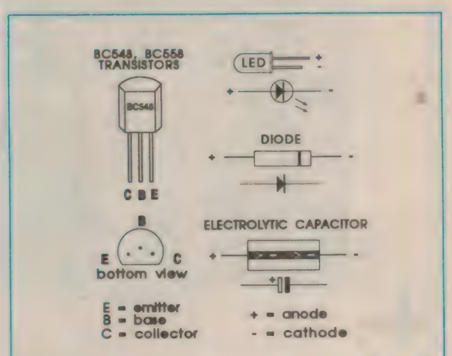


Fig.3: The component leads identification diagram for the polarised components used in the circuit.

mitted signal at the same volume as the signal which you receive.

Assuming that you opt — as we did — for one battery only, and four interconnecting wires, note that capacitor C1 is needed on the unit with the battery attached as well as the other one. Its purpose is to smooth the power supply.

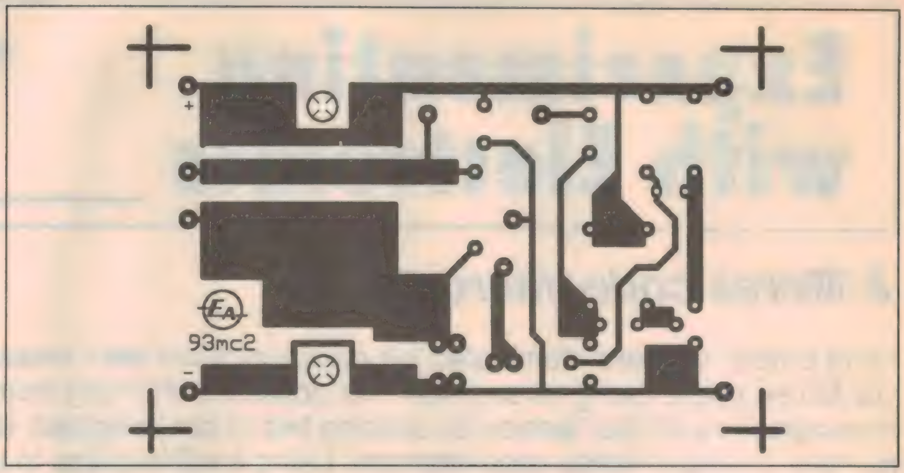
First of all, check that the space that we have left to mount the piezo transducer (BUZ) is large enough to give adequate clearance for all the other components. Then drill the two mounting holes for thin bolts to hold the buzzer on to the PCB.

Next solder the resistors, capacitors and transistors, noting the polarity of the two electrolytics and the BC548s (refer to Fig.3 for details, if you are uncertain). Attach the two leads to the pushbutton (or better, a proper Morse code sender key), then the two leads for the piezo buzzer. The red and black leads on the buzzer must go to the correct pads — the ones marked '+' and '-', respectively (see Fig.1).

Check that unit 1 works, and sounds its own buzzer (though quite softly) when the pushbutton PB1 is pressed. Then build unit 2 which is identical, except for not having a second battery. Remember when linking up the two units that the signal from the 'OUT' on unit 1 must connect to the 'IN' on unit 2, and vice versa.

Changes

The best change that you can make is to use a real Morse code sending key instead of the simple pushbutton that we have used. If you wish to learn Morse code properly, and master a good sending rhythm, such a key is essential. See the later section on 'Learning Morse code' for various useful hints.



The PCB pattern is shown actual size to allow you to etch your own board.

PARTS LIST (for *each* unit)

Miscellaneous
PCB 81x51mm, coded 93mc2
9V battery (unit 1 only)
piezo transducer
momentary make pushbutton PB1
hookup wire, solder, etc.

Resistors
All 1/4W, 5%
2 1k R1,R4 brown-black-red
2 18k R2,R3 brown-grey-orange
1 12k R5 brown-red-orange
1 10k trimpot hor. mount RV1

Capacitors PC-mount electrolytics
1 100uF,16V C1
1 10uF,16V C4

Capacitors polyester (greencap)
2 12nF C2,C3

Semiconductors
2 BC548 NPN transistors Q1,Q2

Another change that you can make is to alter the frequency of the Morse code. Increasing the values of any of the R2/C2 or R3/C3 components will lower the pitch, while making them smaller will increase it.

You can also alter the overall volume of your unit by rotating trimpot RV1. This affects the volumes of both sent and received signals. To alter the relative volumes of these two signals, vary the value of resistor R5 in each circuit.

If you look at the schematic, you can see that the full signal sent out by the oscillator arrives at the top of RV1 in the receiver.

However, in the transmitter, this signal travels via resistor R5 (in both circuits) to reach the sender's RV1. This means that you hear a lower volume signal when you are transmitting than when you are receiving. So reducing the value of R5 will make the sender's volume relatively louder, and increasing it will make it softer.

How it works

We have already seen how an astable multivibrator works — refer to 'Flashing

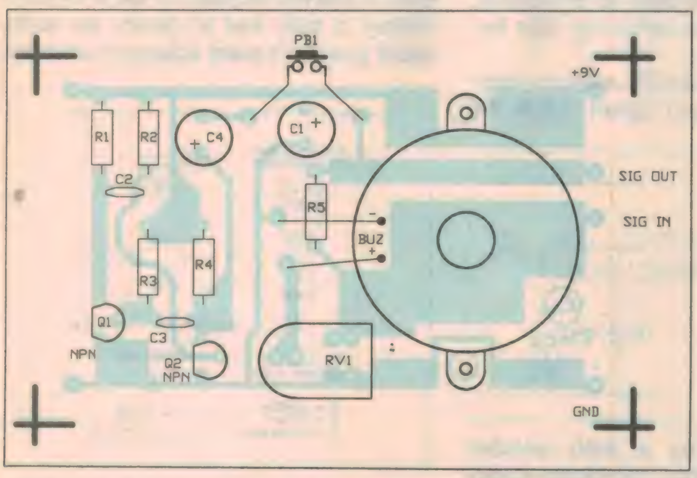


Fig.1: The component layout for the PCB. Check that your particular transducer has enough mounting space before soldering the other components.

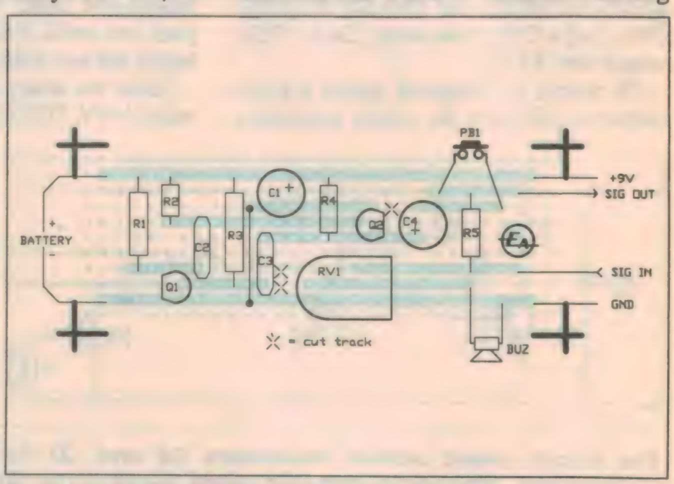


Fig.2: The stripboard layout. As with the PCB construction, only the unit to which the battery is attached requires the smoothing capacitor C1.

MORSE CODE

dah-di-dah-di-dah	message coming
di-dah-di-dah-dit	end of message
di-dah	A
dah-di-di-dit	B
dah-di-dah-dit	C
dah-di-dit	D
dit	E
di-di-dah-dit	F
dah-dah-dit	G
di-di-di-dit	H
di-dit	I
di-dah-dah-dah	J
dah-di-dah	K
di-dah-di-dit	L
dah-dah	M
dah-dit	N
dah-dah-dah	O
di-dah-dah-dit	P
dah-dah-di-dah	Q
di-dah-dit	S
dah	T
di-di-dah	U
di-di-di-dah	V
di-dah-dah	W
dah-di-di-dah	X
dah-di-dah-dah	Y
dah-dah-di-dit	Z
di-dah-dah-dah-dah	1
di-di-dah-dah-dah	2
di-di-di-dah-dah	3
di-di-di-di-dah	4
di-di-di-di-dit	5
dah-di-di-di-dit	6
dah-dah-di-di-dit	7
dah-dah-dah-di-dit	8
dah-dah-dah-dah-dit	9
dah-dah-dah-dah-dah	0

LEDs' (September 1991) and 'Ultrasonic door minder' (November 1992). Here we will restrict our explanation to saying that the length of time it takes resistor R2 to charge up capacitor C2, and similarly R3 for C3, determines the frequency of the output.

As each transistor switches on (e.g. Q1), its associated capacitor (C2) applies a negative voltage to the base of the other transistor (Q2). This keeps the second transistor off until the capacitor becomes sufficiently positively charged via its charging resistor.

If you want to know more about 'time constants' (R x C), refer to the section entitled 'More Theory' in last month's 'Battery Saver' project.

When pushbutton PB1 is pressed, the signal is sent direct to the receiver's piezo transducer, and via the two resistors in parallel (R5 in each circuit) to the sender's transducer. Hence the signal is attenuated via a resistance of 6k (the two 12k resistors in parallel). To give you some idea of scale, using 12k resistors reduced the signal voltage heard by the sender to about one third of that reaching the receiver.

There it is, a very simple circuit to build, but one which should give a lot of pleasure as it introduces you to Morse code.

Learning Morse code

The correct way to learn Morse is to listen to it, and memorise the patterns, *before* attempting to send it! But if you are not prepared to do this (quite understandably), still try to concentrate on the rhythms, and attempt to send your signal in a smooth pattern.

Don't treat the exercise as a straight out memory test, like: *Question*: What is the code for 'A'? *Answer*: dot dash. Rather, listen for the pattern 'di-dah', and associated this with the letter 'A'.

The best way is to get someone else to send the code for a particular letter, and you memorise the pattern so that you can look it up. Dah-dah-dah dah-di-dah — OK?

As well as knowing the patterns, you also need to know the relative lengths of each dit and dah, plus the length of pauses between them, and between each full character and word.

We will make use of the term *baud* (bits of information per second), which is used to describe the speed at which the information is transmitted. So, if we say that 1 baud is the period of a 'dot' (di- or dit), then 3 bauds is the period of a 'dash' (dah); 1 baud is the period between dits and dahs; 3 bauds is the period between characters; and 7 bauds is the period between words.

When you are sending Morse, you should try not to move your arms — ideally, only the wrist should move. You should grasp the knob or handle, with the thumb on one side and with the little finger and ring finger on the other. The other two fingers should rest on the top. It will take a lot of practice to achieve a smooth, rhythmic and relaxed action; but if you're serious about learning Morse, then that's the way to do it!

Happy sending, whether or not you take up Morse seriously, or use it just for fun.

Transparencies

As usual, a high contrast, actual size transparency (negative) for the PCB used in this circuit is available for only $2. This will allow you to etch your own printed circuit board. This special price applies for transparencies for all projects in this series only. Write to *EA*'s reader services division.

Happy experimenting — and please send us your comments on the circuits we have published, as well as ideas for future projects. ❖

DSO Adaptor

Continued from page 84

After graphics initialisation, a main menu apears with 10 options. If the DSOA is connected to LPT2 or an MDPA port, then it must be selected with option 6; otherwise the default setting is LPT1.

Select the size of the waveform memory you wish to use, with option 7. It can be either 2K, 8K or 32K, the last two of which accomodate the different RAM sizes. The 2K setting is useful for quickly reading in a waveform. The memory size selected will also determine the file size when waveforms are transferred to disk.

Two waveforms can be loaded separately into video RAM at once. Option 8 selects either waveform 1 or waveform 2, and this will determine what waveform is read from the DSOA, saved to disk or loaded back in from disk. To retrieve the waveform from the DSOA, select option 1 which will display a progress bar graph as the data is read in. Note that the 32K setting may take some time to load in, depending on the speed of your machine.

Option 2 plots the first 640 points of the currently selected waveform. There is a scroll bar below the waveform that shows the current 'window' position, along the waveform that is being displayed. This can be scrolled with the arrow keys, but the Enter key must be pressed to redraw the window. Press 'X' to expand or contract the size of the current window, with the maximum value dependant on the RAM size setting.

Pressing '1' or '2' selects between the two waveforms, or 'D' displays both at once, which is handy when comparing two waveforms. Note that it is not easy to determine any time values from the screen unless the sample rate is known. The same also applys to the amplitude. This is one limitation of having variable input and sample ranges, but it is usually more important to know what the waveform looks like!

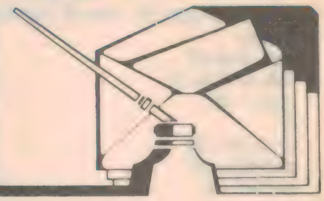
Oh — I almost forgot: where you get the software. This is available only from myself, on either a 3.5" or a 5.25" floppy disk, for only $20 posted anywhere in Australia. Please send cheques only — no cash. I am not able to accept credit card payment, either. Orders should be sent to:

Tronnort Software,
12 Copeland Road,
Lethbridge Park, 2770.

So there you have it, a complete PC-based DSOA that can be built quite cheaply, and will be a valuable addition to your collection of test equipment. ❖

Information centre

Conducted by Peter Phillips



Computers, UHF reception and more

This month we give a solution for car radio interference, introduce a Teletext to computer interface, show how fifteen 1-ohm resistors can be connected to give pi ohms, and even present a computer program to calculate inductor dimensions. But first let me talk about lead times...

I've mentioned this before, but a lot of readers wonder why topics raised in, say the January issue aren't concluded in February. This problem arose with the recent question concerning the 'cartwheel' network.

The question was posed in October '92, and I then got many letters when the November edition appeared. It seems these readers assumed that because nothing had appeared in November, no one had solved the problem. Little did these kind folk know that I had already received the largest number of letters on a particular topic in the magazine's history!

The reason lies in the *lead time* needed to produce the magazine. It takes us a month to put each edition together, then around six weeks for printing. For example, I am writing this in late November 1992, yet you won't read it until late January or early February 1993. This is typical of any magazine, and a fact of life that we need to work around. Obviously continuity suffers, but there's not much we can do about it.

You might wonder *why* this is so, considering newspapers are printed so quickly. The answer lies in the number of staff involved; in the case of a daily paper, there are generally scores of people, all working towards one end: getting the newspaper out each day.

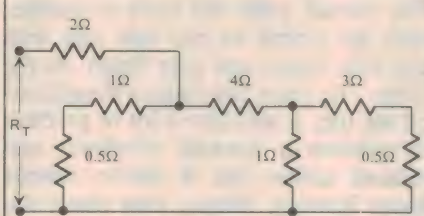
Although *EA* is part of a fairly large organisation, it's one that produces many magazines. For economic reasons, the staff dedicated to any one magazine like *EA* is quite small. If it were increased to a level similar to that of a daily paper, the cost of producing *EA* would put its price out of everyone's reach.

However, I always reply to all letters sent to me, usually within a few weeks, indicating when the topic you've raised should appear (if I'm able to use it). Naturally, if you don't include your address, I can't reply. I replied to everyone who sent a solution to the cartwheel problem, both as a courtesy and because I was unable to print anyone's name due to the large number of replies.

But despite the delays due to production, sometimes a degree of continuity *can* be achieved — such as with our first main topic this month:

Pi ohms

Last month I said I would show the circuit for another network of 1-ohm resistors that gives 'pi' ohms (3.14159292 ohms). The circuit is shown in Fig.1 and was sent by a reader who makes the following comments...



R_T = 3 14159292 ohms, all 1 ohm resistors
total of 15 resistors

Fig.1

The question about a network of 1-ohm resistors to give pi ohms is rather open-ended. My first successful try needed 26 resistors, then 25, 23, 20 and finally 15. What puzzles me is that each of these calculates out to 3.14159292 ohms, even though the configurations vary widely. (B.B., Enoggera Qld).

Thanks for this solution, B.B. — it's the simplest so far. I've shown the circuit in an abbreviated form, where obviously the 2-ohm resistor consists of two series-connected 1-ohm resistors, the 0.5-ohm resistors are made of two parallel-connected resistors and so on. The interesting thing is that some readers suggested a huge number of resistors would be needed. The original answer showed 26 resistors and other readers got the number down to less than this. Perhaps we'll see some even simpler circuits yet.

Teletext to computer

The next topic also suggests continuity from last month and concerns interfacing the Dick Smith Electronics Teletext decoder to a computer. You might remember I suggested this should be possible and that I intended pursuing it as time permits.

I've since received a letter (and a computer disk) that does just this. The writer was prompted by my article describing a few modifications to the DSE decoder, and it seems he has had an interface in operation for some time.

At this stage, I'm not able to print all the details as I need to try it out, learn all about it, and perhaps present it as a small feature article. But to whet your appetite, the interface is a single IC (type 4066), connected to the parallel port of an IBM type computer.

The software is based on an interpreter developed by the writer, and it's planned to offer the software for around $25. So at this stage, all I can say is 'keep watching'.

Now back to topics raised in the November '92 issue.

Car radio interference

The next letter is in reply to a query raised by R.V. (St George's Basin) about car radio interference caused when the

car is in motion. You might remember that R.V. thought his tyres might be the cause. But as it turns out, the answer has nothing to do with the tyres, as our correspondent points out.

I once owned a Peugeot that had a very similar problem to that being experienced by R.V. We eventually traced the trouble to the lack of electrical bonding between the front axles and the vehicle body. The Peugeot used a number of rubber pads to isolate noise and vibration from the cabin, and in this respect it was quite effective. However, we found quite severe static discharge across the pads and it was this that was causing the radio noise.

We made a complete cure by bonding the car body to the front axles. Needless to say the bonds had to be flexible, and we used battery earth straps bolted or clamped to the respective parts of the vehicle. I hope this will help R.V. solve his problem. (B.P., Lenah Valley Tas.).

Thanks B.P., as it turns out R.V. has written back to me saying he has found the reason, which is much the same as you say. In fact, because this could be a fairly common problem, it's worth quoting the relevant part of R.V.'s reply.

Since receiving your suggestion about using a conducting lubricant in the wheel bearings (which shouldn't be necessary as the bearings are tapered roller types), I have further researched the problem.

I have since checked the earthing of the rear wheels (both from the wheel studs to the suspension assemblies and to the main chassis). Surprise, surprise! There was a resistance of 100 ohms between the assemblies and chassis. It was found to vary between 20 and 100 ohms if the car is moved.

It seems the rear suspension assemblies (there are two separate assemblies as the rear suspension is independent) as a whole are fairly well insulated from the car chassis by rubber bushes, etc. Being a front-wheel drive vehicle, there are no mechanical drive components to provide an earth to the rear wheels. A variable resistance of around 100 ohms, or even a few tens of ohms looks like being an accidental leakage path, (possibly via the handbrake cable?) The effect of adding definite chassis earths to the rear wheel suspension seems to be the answer.

So if you are having problems with your car radio reception, it seems the reason often lies in the rubber bushes used to improve the ride. Hopefully, car manufacturers read this column, and as the solution is relatively simple it shouldn't add much to the cost of a car!

```
1     CLS
2     PRINT "DESIGN OF AIR-CORED INDUCTANCE'
3     PRINT "From A. N. Thiele, 1975"
4     PRINT

10    INPUT "Inductance (microhenries)"; L
20    INPUT "Resistance (Ohms)        "; R
30    K = L / R
40    C = SQR(K / 8.66): REM base dimension in millimetres
50    W = .1873 * SQR(L * C): REM length of wire in metres
60    N = 19.88 * SQR(L / C): REM number of turns
70    D = .841 * C / SQR(N): REM wire diam in millimetres
80    G = C * C * C / 21.4: REM gross weight of wire in grams
80    PRINT
100   PRINT "Coil core diameter  ="; 2 * C; "mm"
110   PRINT "Coil core length    ="; C; "mm"
120   PRINT "Coil cheek diameter ="; 4 * C; "mm"
130   PRINT "Wire diameter       ="; D; "mm"
140   PRINT "Weight required     ="; G; "grams"
150   PRINT "Number of turns     ="; N
160   PRINT "Length of wire      ="; W; "metres"
170   PRINT
180   PRINT "Want to try some real values? (Y or N)";
190   GOTO 330

200   INPUT "Core diameter  (mm) "; X
210   INPUT "Core width     (mm) "; Y
220   INPUT "Wire diameter  (mm) "; D
230   INPUT "Number of turns     "; N
240   C = 1.414 * N * D / Y
250   A = (X + C) / 2
260   L = .0394 * A * A * N * N / (6 * A + 9 * Y + 10 * C)
270   R = .0001948 * A * N * N / (Y * C)
280   PRINT "Calculated Inductance = "; L; "uH"
290   PRINT "Calculated Resistance = "; R; "ohms"
300   PRINT "Overall diameter of coil = "; X + C + C; "mm"
310   PRINT

320   PRINT "Want to try different values? (Y or N)";
330   INPUT A$: IF A$ = "y" OR A$ = "Y" THEN GOTO 200
340   END
```

Fig.2

Coils by computer

I've had a few replies concerning a letter presented in November, asking about computer programs to design an air-cored inductor. The next letter gives a very neat solution to the problem, including a computer program listing.

The query from P.S. MacDonald rang a bell in my mind, and I dug up a copy of a paper by A.N. Thiele titled 'Air Cored Inductors for Audio', published in the Proceedings of the IREE for October 1975.

In summary, Thiele states that the coil dimensions are determined by the time constant (L/R) of the coil, not by its inductance alone. He proposes a coil shape which is close to the theoretical optimum, with its inner radius, thickness and width all equal to a calculated dimension 'c'.

I have summarised the steps in the form of a BASIC language program, which I have tested against examples from Thiele's paper. Thiele suggests that errors due to approximations can be avoided by calculating for an inductance say 5% above that required, and removing turns while testing the coil on a bridge until the desired value is obtained.

He also suggests that coil cores are best cut from chip-board and the cheeks from hardboard. The cheeks should be cut about 10% oversize to avoid the last few turns spilling over the edge. The bobbin is assembled with PVA glue with a brass clamping bolt through the centre, which can also be used for mounting. A steel bolt can be used, which will increase the inductance a little. This may or may not be an advantage. (G.M., Dover Gardens SA).

The program listing sent by G.M. is shown in Fig.2. I haven't tried it, but it's obviously for an IBM type computer. Because BASIC is much the same for different computers, you can probably run this program on any computer, with a few minor changes. For instance, CLS (clear screen) is HOME on the Apple.

CD amplifier

The next letter poses a simple question, but one quite a few readers might relate to...

I was recently given a portable CD player. Unfortunately, I don't have the equipment or money to construct a small

amplifier to listen to CD's without headphones. However, I do have a stereo radio/cassette player (Toshiba RT-7025), and I was hoping you could tell me if it's possible to tap in to the radio/cassette's circuitry so I can run the CD player's line output through the preamp and amplifier of the radio/cassette. (A.R., Mount Clear Vic.).

While I don't have the circuit diagram of the radio/cassette unit you refer to A.R., I'm sure it's possible to use it as an amplifier for your CD player. I assume the radio/cassette player doesn't have a line input for recording tapes, as this would be the simplest way.

As a rule, the easiest point to tap into is at the volume control of the radio/cassette player. You'll need to disconnect the existing input, at the outside terminal that is not earth, and either connect a switch as shown in Fig.3, or do away with using the radio/cassette section. The switch selects either the CD player or the radio/cassette.

The circuit in Fig.3 shows one channel only, but you'll need to wire both channels as shown. This method usually works, although the circuitry of your radio/cassette player may not allow it. I suggest you first check if there is a DC voltage anywhere around the volume control, although this is unlikely. If so, you might have to get the circuit diagram of the player and analyse it to find the input to the amplifier section.

Toll barring device

We get a lot of suggestions for projects, and the following comes from a reader whose phone bill appears to be getting out of hand:

I would like to suggest a project that many readers would probably be interested in. I'm referring to a switchable 'toll barring' device, fitted with a key operated switch that could be installed on a telephone line.

When the key is in one position, any attempt to place a toll call would be thwarted, but these would be permitted when the switch is in its other position. Toll barring would operate when the circuit detected a 0 as the first digit, by disconnecting the phone from the line. Such a unit would have the obvious value in preventing one's children, visitors or wife from running up expensive phone bills.

A possible variation would be to have a 3-position switch. In one position, all calls could be made, in the second, international calls only would be blocked

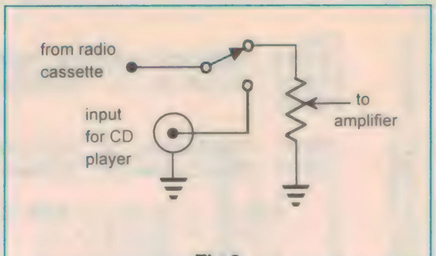


Fig.3

and the third would only permit local calls. Another option might be to bar all outgoing calls. In this position, incoming calls could still be answered. (G.H., Karori NZ).

I suspect such a device would be simple enough to design. A bit of digital logic and a relay or two should be all that's required. Of course, the usual isolation between any mains-operated power supply and the phone lines would be required. If any readers have already developed a suitable unit, we might be able to describe it, or pass on the details to our correspondent.

But I can't help imagining what my wife would say if I fitted such a device to our phone and kept the key to myself.

Still, I empathise with you, G.H. I'm not sure if New Zealand has the ubiquitous 0055 service — it may be a good money earner for telephone companies, but it's not so good for breadwinners with lots of children!

UHF antenna

This letter has been in my files for a while, and concerns modifying the design of a UHF antenna published in the third issue of *Project Electronics*:

I live in the far north-west of NSW, and UHF channels numbers 44 and 47 on 622.25 and 679.25MHz respectively, are now available. I wonder if the channel 28 antenna described in Project Electronics can be used (with modifications) to receive these new channels.

I realise that the dimension of the dipole is a function of frequency and the article explains that the antenna can be modified for other UHF channels by 'scaling down the element dimensions'. I read the word element here as meaning dipole, director and reflector. Could you advise me if the spacing of the elements should be scaled down by the same ratio. (R.W., Brunswick Heads NSW).

In a word, R.W. — yes. Antenna design is based on the wavelength of the intended signal and everything needs to be related to the wavelength of the signal, including the spacing between the elements.

On this topic, I recently had an interesting experience with UHF reception which supports my theory that antenna design is a 'black art', as is reception of UHF. To receive channel 28, I did the usual thing and mounted a multi-element UHF Yagi antenna on top of the mast supporting the VHF antenna. I did all the right things, including correct spacing between the two aerials and so on.

The reception was relatively poor, though watchable. Some years later, I was fiddling around with the antenna connection on my VCR and noticed that I got better channel 28 reception if I used a 25mm length of wire as the antenna. In other words, a piece of 25mm long wire poking out of the antenna input of the VCR!

The interesting thing is that the VCR is on the ground floor, and the UHF antenna on top of the mast attached to the roof, nearly three stories high. My house is on the downside of a hill, so receiving anything on ground level seemed impossible.

Still, being open-minded about the matter, I took the UHF antenna off the mast and restored the VHF antenna to the top of the mast. I then found excellent reception was achieved by mounting the UHF aerial about two metres above ground level, pointing directly into the garden. It's been like that for nearly two years now, and the reception never varies, even in wet weather!

Obviously, UHF transmissions find 'corridors', and hills and other obstacles don't seem to be a problem if they are in the corridor. So, the moral is, it's not the antenna that's critical, it's the position.

Triac & transformer

In November, a reader asked whether my fan speed controller (July '91) could be used to control the output of a transformer. I replied in the affirmative, although I was more concerned whether the controller could cope rather than the transformer. But it seems the transformer mightn't like this, according to our next correspondent...

I manufacture salt chlorinators for swimming pools, and during the design stages, we looked into using a light dimmer to control the primary of a 300VA transformer to give control of the secondary voltage. While looking around for a suitable transformer, I received a message from one of the transformer suppliers urging me to contact a chap called Des, who worked for this supplier.

Des turned out to be very helpful and he warned against using a light dimmer to control a transformer. As I had already established that the method worked, by actually trying it, I was

curious as to his reasons. Des explained that the waveform created in the primary was disastrous to the magnetising curve. I wondered whether he was more concerned as a purist on transformers, rather like a Ferrari being used to tow a trailer load of rubbish to the dump might upset a petrolhead.

I now understand another manufacturer of chlorinators used this method of control, with a lot of subsequent transformer failures. I don't know how the dimmers fared. I have since looked at the waveforms on a CRO, and it is quite obvious Des is correct.

Therefore, I would say to anyone contemplating this idea that for short-term testing, the method works. But it does not appear to be suitable for long-term use, unless you don't mind burning out a few transformers. (R.S., Barmera SA).

Thanks R.S., and to Des. I can't argue against someone who has tried the method and found it burns out transformers, but I still wonder if a suitably rated (or designed) transformer would fare a bit better. After all, transformers are often driven with horrible waveforms, and they seem to survive.

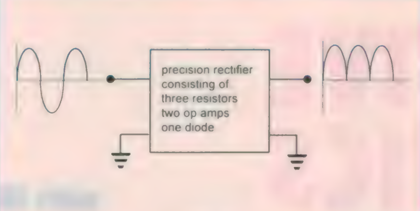


Fig.4

The usual reason for a transformer failing is excessive heat, usually at the centre of the windings. Another reason is over-voltage, causing breakdown between windings.

But given a suitable size core (and VA rating), surely the heat rise could be kept within limits. Still, there may be more to this than we know, so if someone (perhaps even the unknown Des) has some details, I'd be keen to know more on this topic.

LCD glass

The following letter is a request for information:

I am trying to find a source (in Australia if possible) of LCD glass that I can use in electronic welding helmets. This glass is also called Electronic Shutter glass, or just Electronic glass. The size I need is 100mm by 100mm. If anyone can help, please contact Peter Mellander, 2/108 Ballandella Road, Pendle Hill, NSW 2145.

I assume this type of glass has the polarising properties associated with an LCD display, and because of the proliferation of these displays, surely a local source should be available. If anyone can help our reader, please write to him.

What??

I have an op-amp question for you this month. The question concerns a precision full-wave rectifier and was sent to me by Gordon Wormald, of Florey in the ACT. However, the question as originally posed by Gordon seemed too easy. Because we can't have that, I've taken the liberty of reversing the question, which gave the circuit and asked for the waveforms. Instead, you get the waveforms and your task is to draw the circuit.

So the question is, sketch the simplest op-amp circuit that achieves the function shown in Fig.4 in which the output is a full-wave rectified version of the input. You should be able to achieve this with three resistors, ONE diode and two op-amps. Naturally, anything less is even better!

Answer to January What??

The logic circuit is shown in Fig.5. The circuit was drawn in *Electronics Workbench*, and you'll notice it includes a waveform generator and a logic analyser. I did this to make sure the circuit I drew worked.

The display on the analyser proves the circuit, in which input A is the top waveform and output A-bar is the one below it. The next pair of waveforms are input B with output B-bar below. The bottom pair are for input C and output-C bar.

As you can see, the outputs are always the opposite of the inputs. In case you're wondering, there are 19 AND gates, 15 OR gates and the specified two inverters. Obviously it's an academic circuit, as using three inverters would save a lot of PCB space! ❖

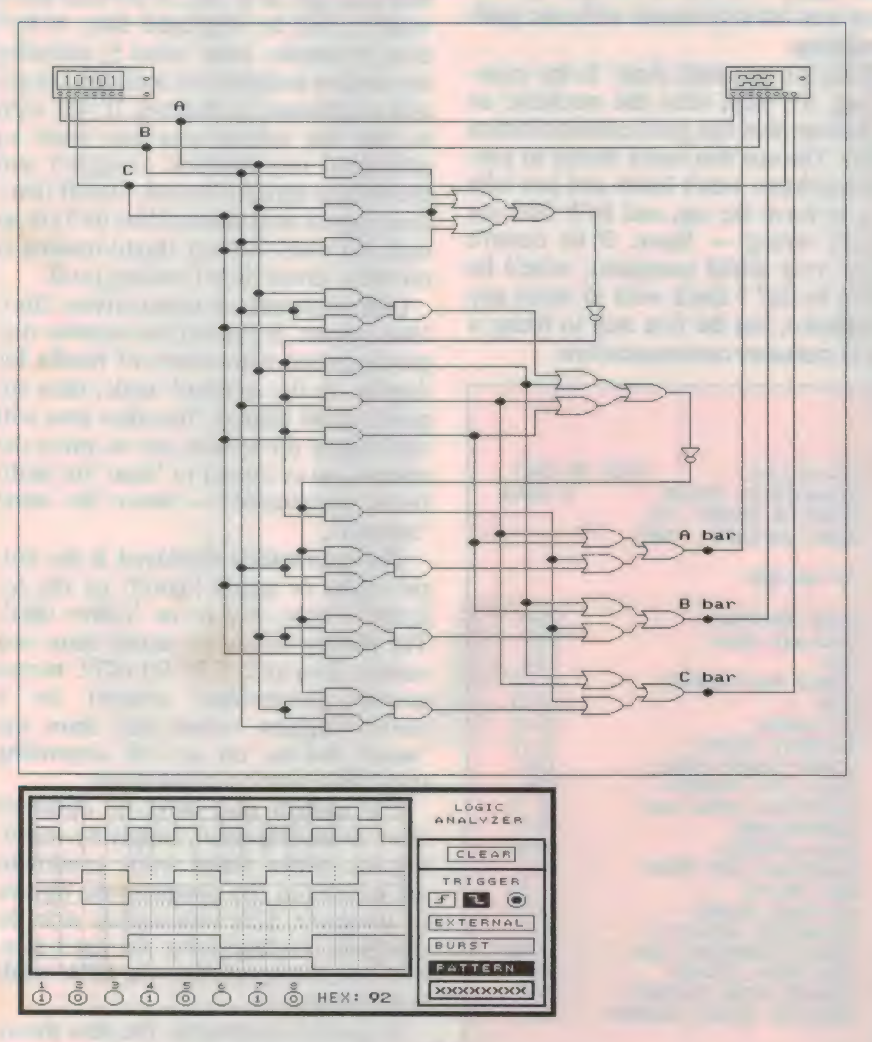
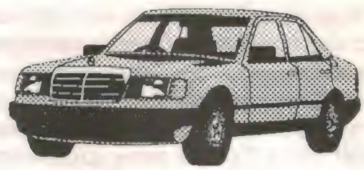


Fig.5

AUTOMOTIVE ELECTRONICS



with MAJOR AL YOUNGER (USAR, Ret.)

Automotive data scanners — 2

In the last article, we discussed the basic scanner types and code retrieval. This time we discuss the meaning of diagnostic codes, active data and features of various scanners.

In the last article, we hooked the scanner (Fig.1) up to a Ford and retrieved a diagnostic code like #26: 'MAF (mass air flow) out of range'. But what do you do when you get this fault code — change the sensor? Not necessarily; It's back to basics time again.

A collapsed or clogged air filter, an air leak (allowing un-metered air entry) in the duct, poor connections, and so on may 'set' this code. As I noted last time, the hard part is interpreting the code, which is left to the mechanic.

An important point: if a system does not 'set' or present a fault code, does that mean there are no problems in the system? No, because many ECM systems do not have memory to store an intermittent fault. If your 'check engine' lamp comes on while driving, then goes off, see your mechanic. Faults like this are hard to find, on systems that do not store intermittent faults. Expect a bill for diagnostics, even though the mechanic may not have been able to find the problem. Intermittent faults are difficult to find in any electric or electronic products, as you probably know.

Some people take their car from shop to shop, to 'get answers' and accumulate bills. If you're one of those people, let me ask you this: If you had a toothache, how many dentists would you go to? Your best bet is to remain with one qualified shop.

What's a qualified shop? In my experience, it's most often the mechanic or technician that has good communication skills. The one that really listens to you. If a mechanic won't listen, and just tells you to leave the car, and he'll find out what's wrong — leave. If he doesn't know your initial complaint, what's he going to fix? I don't wish to insult any mechanics, but the first step in fixing a car is customer communications.

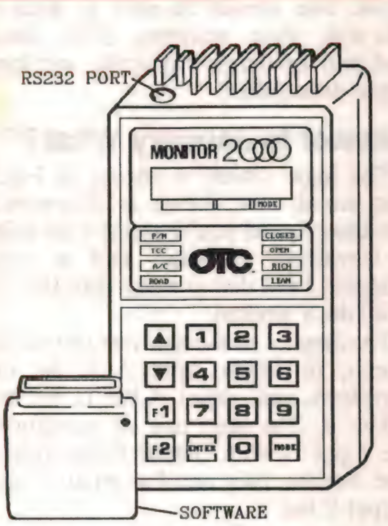


Fig.1 (above): A typical hand-held scanner.

```
GM-HOLDEN              3800 V6 PFI
DIAGNOSTIC STATE            8 ALCL
TROUBLE CODES: NO
HIGH BATTERY    OFF

VN HOLDEN

HIGH BATTERY                 OFF
COOLANT TEMP                 084
MAP                          035
THROT POS SENSOR             0.62
RPM                          0725
O2 VOLTS                     0.67
BATTERY VOLTS                13.9
BLOCK LEARN MULT             128
IDLE AIR CONTROL             050
INJECTOR FUEL FLO            01.2
INTEGRATOR                   128
LOOP STATUS                  OPEN
MANIFOLD AIR TEMP            066
MAP VOLTS                    1.35
O2 FUEL STATE                RICH
THROTTLE ANGLE %             012
TRANS OVERTEMP IND           NORM
4TH GEAR STATUS              NO
TORQUE CONV CLUTCH           OFF
VEHICLE SPEED SENSOR         000
```

Fig.2 (right): With many scanners, you can get a printed copy of the diagnostic data, by connecting a printer.

Active data

Let's connect our scanner to say a GM Holden, and look at 'active data' or 'data stream' produced by the ECM. The starting procedure is the same, but the choices are different.

On some scanners, we enter 'Data stream', then select the address — entered as a combination of 'word number' and data type as a 'bit'. If the data has a value it will be displayed live, in real time. Example: enter word 5, meaning say coolant temperature, and read the actual temperature in degrees. If you wish to read the voltage you may enter an additional test function ('toggle') and the voltage appears instead. On/off functions appear as individual bits (0-7) in an eight-bit word. An 'up' (high) reading is on and a 'down' (low) reading is off.

Other scanners are menu driven. Once 'data stream' is entered, the scanner displays a menu with choice of modes for display. In the standard mode, data appears on the display. The view area will not display all sensors, so we press the arrows (up or down) to 'scan' for additional information — hence the name 'scanner'.

The information displayed is the output value or status (on/off) of the selected sensor, live or as 'active data'. The display shows the sensor name and values. Example: CTS 90 (CTS means coolant temperature sensor) for a switch-function sensor will show the 'name' and an 'on' or 'off' depending upon the sensor's current status.

The system may now be observed 'live' or in 'real time', simply by watching the sensor status while conditions are varied (i.e., by operating the throttle or whatever. This information aids the mechanic in diagnosing the car's trouble, since this is the data the ECM reads and controls.

Of course *interpreting* the data shown on the scanner is where mechanics must apply all of their knowledge, in order to

fix the car. All the scanner shows is the actual data being collected by the ECM and sent by it to various actuators. The mechanic must now interpret this data to determine the cause of any fault and take corrective action. For example they must now decide if the problem is mechanical or electronic. To accomplish this it is imperative that you have a thorough knowledge of the basics of both disciplines.

Features and options

Printing: Many scanners allow you to get a permanent record of the diagnostic data, if you want this (Fig.2). This is done simply by sending the information to a printer. A DC-operated serial printer makes the complete system portable.

Generally you just enter the command for 'Print', to produce a hard copy of all the data readings. It's great to show the customer — I tell them "I talked to your car's computer, and here's what it said!"

Recording: This is another scanner feature which can be an excellent aid in diagnosing intermittent problems. Test drive the car, and when the trouble appears, press 'Record'. You now have a record (Fig.3) of the ECM 'events' at the time of the trouble being evident. The '0' is the time you pushed 'Record' to capture the fault.

DIAGNOSTIC SYSTEM

GM-HOLDEN 3800 V6 PFI
EVENT 1 TAG — FRAME -00
DIAGNOSTIC STATE 8 ALCL
TROUBLE CODES: NO
HIGH BATTERY OFF

VN HOLDEN

	-2	-1	-0	+1	+2
HIGH BATTERY	OFF	OFF	OFF	OFF	OFF
COOLANT TEMP	084	084	084	084	084
MAP	035	035	036	036	035
THROT POS SENSOR	0.62	0.62	0.62	0.62	0.62
RPM	0725	0750	0725	0700	0750
O2 VOLTS	0.67	0.67	0.65	0.45	0.71
BATTERY VOLTS	13.9	13.9	13.9	13.8	13.9
BLOCK LEARN MULT	128	128	128	128	128
IDLE AIR CONTROL	050	050	050	050	050
INJECTOR FUEL FLO	01.2	01.8	01.8	01.5	01.5
INTEGRATOR	128	128	128	128	128
LOOP STATUS	OPEN	OPEN	OPEN	OPEN	OPEN
MANIFOLD AIR TEMP	066	066	066	067	067
MAP VOLTS	1.35	1.33	1.39	1.39	1.33
O2 FUEL STATE	RICH	RICH	RICH	RICH	RICH
THROTTLE ANGLE %	012	012	012	012	012
TRANS OVERTEMP IN	NORM	NORM	NORM	NORM	NORM
4TH GEAR STATUS	NO	NO	NO	NO	NO
TORQUE CONV CLUTC	OFF	OFF	OFF	OFF	OFF
VEHICLE SPEED SEN	000	000	000	000	000

Fig.3: Some scanners allow you to 'Record' the data coming from the ECM, so you can take a 'snapshot' of system status. Here the status has been captured at a particular time (0), as well as two instants before (-1, -2) and after (+1 and +2).

Generally you observe the data later, either on the scanner itself, printed out or on a terminal or PC screen, until the fault is found. I have used this feature to find and fix some very difficult problems, at times.

Graphing: This is a very useful software program. It allows graphing sensor output data to screen or printer. It is a very good teaching aid. You can monitor the interaction of various sensors under operating conditions.

PC or terminal control: This is also a software function, is now available for some scanners. It allows live monitoring of data (Fig.4). The figure shows page 01 (basic info) of 14 pages of information. How much information is available depends upon the vehicle model and system — they're not all the same.

I guess I don't need to tell you electronics people what can be achieved if equipment is fitted with an RS-232 port. It lets you 'talk to the world', and this applies just as much to an automotive scanner as it does to anything else.

In North America, there are already auto diagnostic data *networks* in operation. Just modem the data from your scanner, and it's analysed by the experts and returned with the corrective actions they advise.

I like to say 'Programmers will run (fix) the world'. Using a computer to fix a computer is not new. The equipment is in place; now it's in the programmers' court. The present programs for scanner data usage with a PC are mediocre at best, and not 'user friendly'. But that'll change before long.

About this time, those of you who may be professional programmers are probably exclaiming 'There's programs out that will do that!' Right, but the key words are 'user friendly'.

I found out a long time ago that that term is relative. What is 'user friendly' to many software vendors is often way beyond the capabilities of many a 'key cruncher'. I personally get very irritated when purchasing a program that comes with five kilo's of manuals to read. 'Pull down' menues, 'on-line help' and 'tutorials' are great, but that's not what's required in a working ambience. If a mechanic has to stop and look in a book — what will the customer think?

A 'menu driven' program is most acceptable. An important factor is conditions in the automotive workshop. I have my keyboard covered with plastic wrap, to keep out grease; at the end of the week it has to be changed — because at present, too much data has to be entered.

If an interested party would like to discuss the program requirements, I'll be glad to hear from them. Such a software product is marketable worldwide.

Yes, the time is near, when you'll be able to hook up to a car and the PC will tell you exactly what's wrong. For some vehicles, with data stream output, that time could have been today, if the software was available. The future in automotive electronics is wide open — for people whom are not afraid of getting their hands a little dirty, while using their mind.

The 'electronic' car

Electronics people have generally solved the problems of achieving reliable electronics operation in a harsh environment. It has been my personal experience that an 'electronic' car can be far superior in performance and reliability, than non-electronic models. But they do still require simple routine maintenance, just like their predecessors.

Many problems in basics effect the operation of electronic control. The ECM will attempt to overcome such problems, and this effects system operation. What is true in computers is still true here: 'garbage in, garbage out'. A simple poor connection may affect a sensor's data. The ECM will interact with the apparent fault condition this creates — it can't correct for it.

In many systems the ECM will default to the 'limp mode'. Most systems will give an indication in this mode, i.e., the 'check engine' lamp will light.

Let me give you a scenario of what happens with no maintenance. This most often occurs within 40 to 60 kilometres, or sooner if you have been in the 'bush' or made long trips.

The engine 'backfires', either when starting or on the road. Your system has a mechanical air flow meter (AFM); it's now out of calibration. (Note: backfires can physically damage an AFM.)

The problem continues to get worse, with starting more difficult and an increase in 'backfires', sniffing, snarling and wheezing. This is often caused by a clogged air filter, an air vent leak (unmetered air) or the fuel filter is full of 'trash' (creating a flow problem). It's now probably too late: you need another AFM, and these are very dear.

If your vehicle has a manifold absolute pressure (MAP) sensor and a 'backfire' occurs, the membrane cracks and the same problem occurs, for the same reasons — poor maintenance.

To summarise, when the system acts up, it is most often too late to perform the required maintenance, to solve the

problem. And, if the AFM or MAP is replaced, the maintenance *must* be done. This is just an example of a particular air problem; fuel problems are similar. However, proper maintenance most often solves both problems. The best advice is see your mechanic and set up a scheduled preventive maintenance program. The money you save is yours, not to mention the frustration.

Finding faults

What were we talking about, when I got side tracked? Oh yes — scanners!

The scanner is an ideal tool for testing cars with what is termed 'driveability' problems. Simply check the system with the engine cold, then when hot and perhaps also during a test drive. If a fault occurs the scanner will generally show what's happening. I have a set procedure, for different systems, that is very successful in finding faults.

They are the mechanic's interface, from the vehicle to the outside world. When used properly, a scanner is an extraordinary tool for fixing a modern automobile.

The advent of scanners is not the end of automobile problems, but it *is* the beginning of the end — to the difficulties in finding and fixing the faults in vehicles with electronic control modules.

In the coming articles, we will look more closely at the scanners that are currently available on the market. Then we'll continue with more specialised electronic equipment used to fix or maintain the electronic automobile.

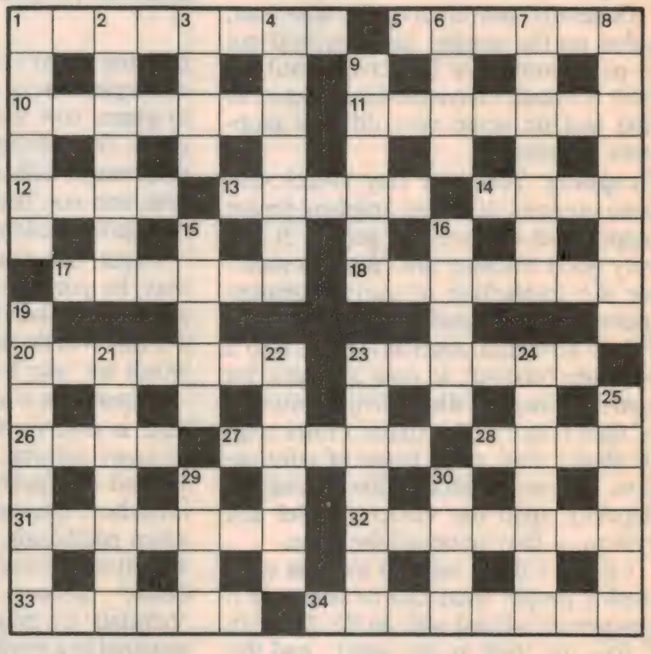
I'll also be happy to answer your basic questions on electronic fuel injection and ECM operation in the magazine, subject to the usual *Electronics Australia* rules. But please, questions on electronic controlled vehicles only — not stuff you could get from your car's servicing manual or from a conventional textbook. Send your queries to:

Major Al Younger,
PO Box 477,
Double Bay, NSW 2028.

For additional information on scanners, call Neville on (02) 708 3360. If you want more information on interpreting diagnostic codes from scanners, I still have *The Code Book* available for $35.00; just send a cheque with your order, to the above address. And if you maintain your own car, my other booklet *Maintaining the Electronic Motorcar* is also available for $25.00. ❖

Fig.4: Some scanners can be hooked up to a PC, and with suitable software you can access and display more data. This is page 01 of 14 'pages' of data...

EA CROSSWORD



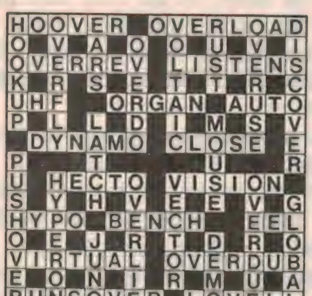
ACROSS

1. Radiators of a form of energy. (8)
5. Characteristic of AC supply. (6)
10. Said of an atom in higher energy state. (7)
11. Not adjusted to a particular frequency. (7)
12. A deposit that might be located by a metal detector. (4)
13 Connecting item. (5)
14. Kind of filter. (4)
17. Valve. (4)
18. Extremely fast particle. (7)
20. Make new design. (7)
23. Concerned with a certain electrode. (6)
26. Metrix prefix indicating a billionth. (4)
27. Memory in computer system. (5)
28. Abbreviated term for variable resistors. (4)
31. Silhouette; pattern. (7)
32. Operate computer with substitute data. (7)
33. Serviceman's diagnostic instrument. (6)
34. Long TV program. (8)

DOWN

1. Rises and falls in sound volume. (6)
2. Device that converts data to desired form. (7)
3. Marconi used this to support a receiving antenna. (4)
4. Initiate and transmit. (7)
6. High density television, (abbr.). (4)
7. State of being tuned. (7)
8. Range of adjacent frequencies. (4.4)
9. Power receptacle. (6)
15. These have p.d. across them. (5)
16. First-broadcast news item. (5)
19. Computer's paperwork. (5-3)
21. Units of time. (7)
22. Preliminary strip of tape or film. (6)
23. One who might be timed electronically. (7)
24. Line on a chart joining points of same depth. (7)
25. Where might a submarine's towed array be? (6)
29. Flexible conductor. (4)
30. Melt through overheating. (4)

SOLUTION FOR JANUARY 1993



EA with ETI marketplace

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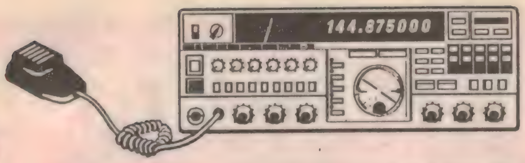
Amateur Radio News



YL's ATV record

The WIA's general manager Bill Roper VK3ARZ reports that Simone Buck, VK2TOY/P, has gained a Certificate of Achievement for an ATV contact on 1250MHz with VK2ZQW/P, over a distance of 105.7km.

According to John Martin VK3ZJC, Chairman FeTAC, the first YL member to gain a distance record was Joan Wallace VK4BJE, who with her husband VK4KHZ set a 50MHz record of 21,754km in March 1991.

1993 Call Book

Bill Roper also advises that the WIA's Divisional offices now have adequate stocks of the *1993 Australian Radio Amateur Call Book*. This edition contains over 40 pages of reference material and information about band plans, repeaters, distance records and contests, DXCC countries and accredited examiners, as well as the listing of over 18,000 Australian callsigns.

Described by some early readers as the WIA's 'best ever' production, this year it uses a clearer typeface than some previous editions, for the benefit of those with poorer eyesight.

Repeater operation

In his latest newsletter to hand, Bill also comments that many amateurs still don't seem to have the 'hang' of repeater operation. While customs vary from state to state the basic principles remain, but despite this many repeaters are misused at times, either deliberately or unknowingly.

The *1993 Call Book* apparently includes a short guide to use of voice repeaters. Normal good manners should prevail during repeater operation as well as on HF. Despite some deregulation, it is still necessary to identify your transmissions at the appropriate intervals, and to refrain from making unidentified transmissions.

Bill suggests that if you're new to repeaters, you should listen for a while before participating — to ensure that you observe the local conventions. Hopefully, more experienced operators will educate the newcomers in correct usage.

New handhelds from Kenwood

Kenwood Electronics has just expanded its range of amateur radio gear with the launch of two new handheld FM transceivers, the TH-78A and the TH-28A. Both are very compact and take advantage of the latest SMD technology.

The TH-78A is a 2m/70cm dual band unit, claimed to be the smallest yet produced. It offers full duplex cross-band operation, with the ability also to receive two frequencies simultaneously on the same band. Offering 50 non-volatile memory channels, it can store not only transmit and receive frequency data, but CTCSS data and DTSS (dual-tone squelch system) codes as well. A six-character alphanumeric readout allows display of callsigns, etc.

Measuring only 134 x 49.5 x 41mm and weighing 400g (with battery), the TH-78A offers a choice of three switched RF output levels (5W/500mW/20mW, with PB-17 battery back). It operates from 144-148MHz and 430-440MHz, although the 2m receiver covers from 136-174MHz. RRP for the TH-78A is $879.

The TH-28A is described as Kenwood's 'little brother' to the TH-78A. It combines the same 2m/70cm dual band reception capability with a single-band 2m transmitter section. Apart from this, the two are quite similar. Measuring 116 x 49.5 x 38mm and weighing only 330g with the PB-13 battery pack, the TH-28A has an RRP of $549.

Kenwood sponsors WIA promotion

Kenwood is also currently sponsoring a recruitment/renewal promotion by the NSW Division of the WIA, to help it lift membership levels. Those who join up, or renew their membership before February 28, 1993 will be eligible to win one of two new Kenwood transceivers.

First prize is a TM-732A dual band 2m/70cm mobile rig valued at around $1250, while second prize is one of the new TH-28A dual band handhelds mentioned above. Both prizes will be awarded by way of a draw, and the winners will be announced shortly after the promotion closes.

All grades of membership are eligible for entry into the draw, so if you have been thinking of joining, or are due to renew, now would be a good time to act!

Kenwood's new FM handhelds: at left is the TH-78A, which offers full duplex cross-band operation, or reception of two frequencies simultaneously on the same band. The TH-28A at right can transmit only on the 2m band.

Further details are available from the Wireless Institute of Australia NSW Division, PO Box 1066, Parramatta 2124. The Division's office at 109 Wigram Street Parramatta is also open from 10am to 2pm weekdays, and 7-9pm Wednesday evenings; phone (02) 689 2417, or fax (02) 633 1525.

Electronics Australia's

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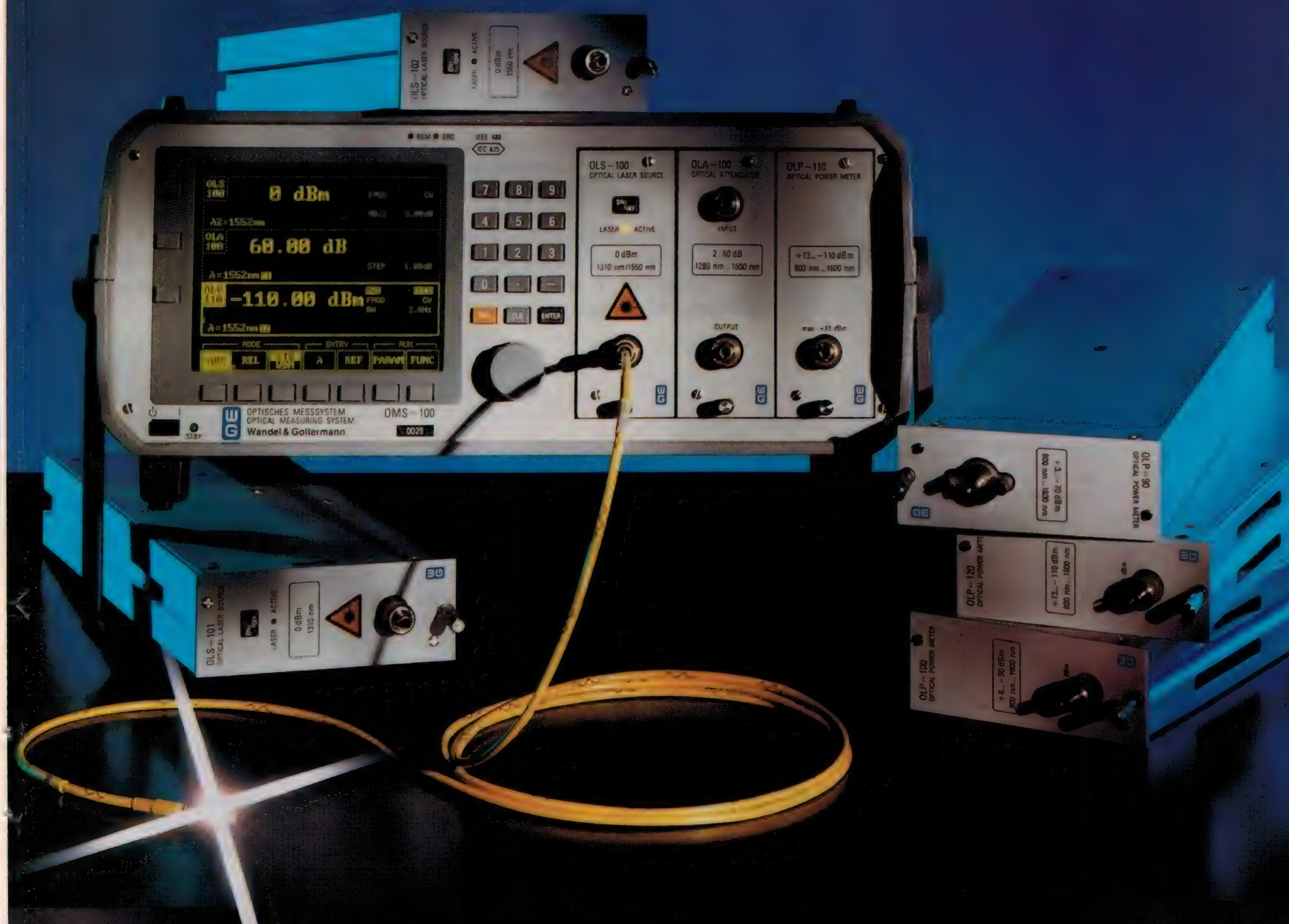
INMARSAT PLANNING GLOBAL SATELLITE PHONE BY 2000

REVIEW OF H-P'S NEW LOW COST 300DPI FLAT-BED SCANNER

PC-DRIVEN PROTO BOARD KIT FOR 8051 MICROCONTROLLERS



NEW MODULAR FIBRE OPTICS TEST SYSTEM FROM WANDEL & GOLTERMANN HANDLES MULTIPLE SIGNALS

NEWS HIGHLIGHTS

DARESBURY LINAC MOVING TO ANU

Following a decision by the UK Government to close down its SERC (Science and Engineering Research Council) Nuclear Structure Facility in Daresbury, the Australian National University's Research School of Physical Sciences and Engineering is acquiring the facility's Linac superconducting linear accelerator. Previously unused, the accelerator is to be refurbished and installed in the School's Department of Nuclear Physics.

The new accelerator is planned to be fully operational by mid-1995. It will be used to double the energy output from the School's existing 14UD accelerator, increasing its capacity to accelerate heavy nuclei.

With the UK winding down its Daresbury laboratory, the ANU School will now be one of the few facilities in the world where basic research into nuclear structure can be carried out. In return for handing over the Linac, UK physicists will have extensive access to the School's improved facilities.

IC FAB COSTS TO RISE TENFOLD

US technology market research company Electronic Trend Publications is predicting that the cost of establishing an IC fabrication plant with a capacity of 10,000 wafer starts per month will increase tenfold, from US$200 million to US$2 billion, by the year 2000. The increase is expected to be due largely to the cost of achieving smaller design features, down to 0.12 micron pitch.

Already, because of the rising cost of chip fabrication, more and more US semiconductor firms are turning to third-party foundries. ETP reports that at last count, more than 100 firms were now using contract IC wafer fab services. It also forecasts that the total worldwide IC foundry service business will grow from US$2.2 billion in 1992 to US$7.7 billion by 1997.

This information is taken from the ETP report 'The Worldwide IC Wafer Fab Foundry Market', available for US$1500 from ETP at 12930 Saratoga Avenue, Suite B5, Saratoga CA 95070, USA; phone (408) 996 7416, or fax (408) 996 7871.

MITSUBISHI/TETIA SEMINAR FOR HOBART

For several years, a Mitsubishi Electric-AWA team has been travelling Australia presenting training seminars to members of The Electronic Technicians Institute of Australia (TETIA). Headed by the Company's National Service Manager, Ruben Ferrero, the Mitsubishi team has given valuable hands-on experience to hundreds of technicians around the country.

The seminars, organised by TETIA and delivered by Mitsubishi, are usually held in the capital cities and only the registration fee is allowable as a tax deduction. Country members can claim travel expenses, but this advantage is not generally available to city members. But the latest TETIA seminar is planned to give everyone, members and non-members alike, a worthwhile tax deduction on their next year's return.

The seminar is to be held in Hobart, at the luxurious Wrest Point Hotel/Casino, over the weekend of 13-14th March, 1993. The topics to be discussed include theory, practice and servicing of TV and video recorders, fax machines, microwave ovens, CD players and cellular telephones.

The Mitsubishi team includes specialists in each product line, and the lectures cover design philosophy as well as the practical aspects of service. There is ample time for discussions and the audience is encouraged to question the lecturer throughout the session.

Wherever practical, Mitsubishi arranges for hands-on experience, supplying the chassis and tools needed to service the product. The Company also issues voluminous notes, circuit diagrams and even complete service manuals to those attending their seminars.

The seminar is being organised by the Tasmanian Division of the Institute, which can assist with travel and accommodation arrangements for interstate visitors, both members and non members alike.

For further information contact TETIA Activities Officer Cliff Townsend, 27 Alma Road, Orford 7190, or phone him on (002) 571 266.

SOFTWARE FOR PC VIDEO

Silicon Valley microprocessor maker Intel has introduced a software technology it calls 'Indeo', developed to bring video capability to all personal computers based on the firm's 386 or 486 processors. Intel is licensing the technology for use in both operating systems and applications software, to allow the incorporation of video information. No special hardware is needed, although the software can take advantage of video accelerator hardware if this is fitted.

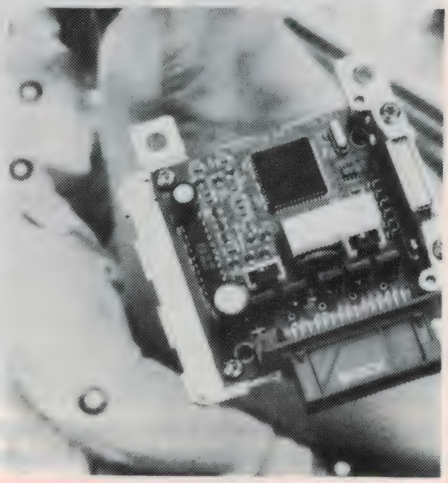
One of the first products to incorporate Indeo technology is Microsoft's new *Video for Windows* package, which provides tools for playing back, incorporating, editing and creating compressed digital video, for Windows 3.1.

Indeo has the ability to adapt its performance to the hardware available, a fea-

JAPAN TO MAKE AIRBAG TRIGGERS

German-based auto electronics maker Robert Bosch is to have its electronic safety restraint airbag triggering units manufactured in Japan, by a joint venture company it has formed with Zexel Corporation of Tokyo. This development follows on from Bosch's agreement in 1991 with US firm Morton International, to jointly develop airbag systems in the USA. By co-operating with Morton, the market leader in gas generators for airbags, Bosch will be able to offer complete restraint systems.

Of particular importance for further development in this market is the decision of the German car industry to recognise the Bosch triggering unit as the standard for a future integrated triggering unit. A key element of the Bosch triggering system is an electronic acceleration sensor. Data is received by the triggering electronics and analysed in a few milliseconds, to determine whether the cause is only a minor parking mishap or bump, or an accident for which the airbag must be activated.



ture called 'scalable performance'. Hence a video clip will play back on a 386-based PC at 15fps on 1/10th of the screen, but on a 486-based machine will be played back at 24fps on 1/4 of the screen. Adding an accelerator card based on Intel's i750 video processor allows playback at 30pfs with a full-screen image.

Indeo technology uses real-time video compression and decompression, to avoid the enormous disk storage capacity which would otherwise be required for digital video.

INMARSAT PLANS SAT PHONE BY 2000

International satellite communications consortium Inmarsat is moving rapidly with the development of a global hand-held satellite phone system, which it aims to introduce commercially by 1998-2000.

The consortium's governing Council met recently in London and unanimously concluded that the advanced system, code-named Inmarsat-P, is both technically feasible and a promising business opportunity for the organisation. It is expected that by July 1993, remaining technical and market issues will have been resolved, allowing Inmarsat's owners to take an investment decision.

The Inmarsat-P terminal will be a lightweight hand-held telephone useable around the world, offering a voice quality similar to that of digital dellular systems. In fact the prototype design incorporates a dual-mode feature, so that it operates as a normal cellular phone when within range of a cellular system.

Price of the terminal is expected to be around US$1500, with a satellite retail usage charge of around US$2 per minute.

Inmarsat-P will also support Group III fax and data services to 2400bps data, in addition to full duplex voice.

AUST. PHOTONICS R&D CENTRE OPENED

The Australian Photonics Co-operative Research Centre (APCRC) at Sydney University has been opened by the Hon. Ross Free MP, Minister for Science and Technology and Minister Assisting the PM, at a ceremony hosted by APCRC chairman Sir Robert Cotton.

The APCRC brings together the research efforts of the Optical Fibre Technology Centre at the University of Sydney, the Photonic Network and Systems Centre at the University of Melbourne and the Optical Sciences Centre at the Australian National University.

The Federal Government is to provide nearly $27 million in funding over the Centre's seven-year life, with a further injection of well over $40 million in cash and in-kind resources by participants including AOTC, Siemens, NEC, Fibernet, Pacific Power and the Australian Communications and Computing Institute.

The APCRC has already commenced its $100 million, seven-year program of applied research into optical fibre technology, the goal of which is to exploit the capacity of fibre optics to transmit high-bandwidth information over long distances.

SCHEMATIC CAPTURE FOR WINDOWS

Hobart-based CAD software developer Protel Technology, which recently released a Windows version of its very widely used PCB design package, has now released a companion schematic capture package.

The new *Advanced Schematic for Windows* is upward file compatible with both Protel Schematic 3 and OrCAD SDT files, so that existing user files can be ported over to the new package. The package also supports a very wide range of netlist formats, including those used by most popular PCB design and simulator packages.

Other features of the new package include a multiple document interface (MDI), on-the-fly component library editing, text editing tools using True Type fonts, colour coding, powerful global edits, graphic file importing and of course Windows support for a large range of graphics cards, printers and plotters.

A Project Manager facility allows loading of multiple projects and/or multiple-sheet files, limited only by available memory, which a 'visual navigator' provides direct access to any sheet.

Further information is available from Protel Technology, GPO Box 204, Hobart 7001 or phone (002) 73 0100.

AWA FUNDS UNIVERSITY R&D

AWA has announced the award of a research and development contract worth more than $300,000 to the University of Wollongong's Centre for Information Technology Research (CITR).

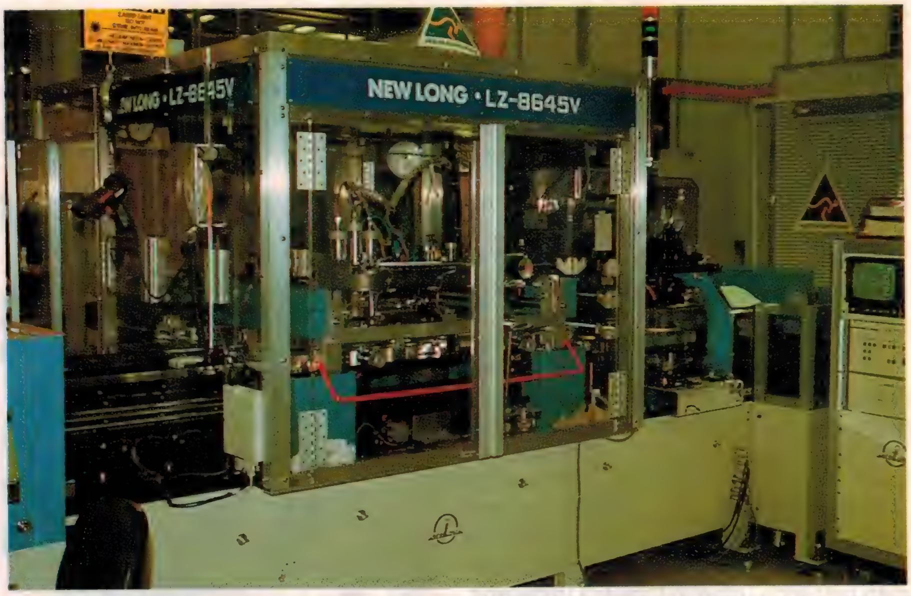
The contract will fund work designed

to expand the capability of AWANET, the company's Fibre Distributed Data Interface II (FDDI-II) multi-media switch, by providing high-speed network interconnection. AWA will fund the contract from its recently established syndicated research and development project for AWANET.

Announcing the contract, Mr John Dougall, Managing Director of AWA Limited, said "AWA views this project as the start of a long-term, mutually-beneficial relationship with one of Australia's leading telecommunications research bodies that will ensure the company maintains a competitive edge with its technology. CITR's rapid growth and close working relationship with AOTC is testimony of its skills and capabilities."

Dr Ian Reinecke, Director CITR, said the research project was in an area of tremendous technical and commercial interest as telecommunications networks evolved towards broadband highways carrying voice, data and video.

Although CITR conducted research in conjunction with some of the largest telecommunications carriers and equipment suppliers in the world, this was its first substantial project with an Australian manufacturer.



Part of IBM Australia's Wangaratta plant is this Newlong LZ8645V screen printer, used to apply solder paste to the top surface of PC boards.

CONTRACT WORK FOR WANGARATTA PLANT

IBM Australia's manufacturing plant at Wangaratta in Victoria has recently moved to contract its state of the art facilities to other manufacturers, for production based on electronic technology — such as diskette replication, box fabrication, assembly, testing, pin-in-hole and surface mount circuit board assembly, integration and pre-loading of software.

IBM Australia is also offering customers a wide and integrated range of additional services including consultation, design, packaging, distribution and export. Located on the Hume Highway 230 kilometres from Melbourne, the IBM Wangaratta plant employs 173 people, most of whom have tertiary qualifications in engineering or other disciplines. Manufacturing staff are implemented by a pool of 500 locally trained casual workers.

Working to broaden its production base, the plant is now manufacturing products for a number of customers independent of IBM, in addition to diskette replication of IBM products and current production of IBM PS/2 and RISC System/6000 computers, and kanji desktop controllers.

Announcing the new role for the plant earlier this year, General Manager Manufacturing and Development for IBM Australia, Ravi Marwaha, said the development represented a major change in strategy for the plant.

"While exports from the plant have been increasing, and in 1991 were valued at $133 million — now over 70% of production — it is also essential to cater for the local market," Mr Marwaha said.

S-A WINS $10M SATELLITE SUBCONTRACT

Scientific Atlanta has been awarded a $10 million subcontract to supply Indonesia with vital equipment to monitor weather data from some of the country's most remote areas.

The contract is for a new solar-powered VSAT (Very Small Aperture Terminal) network, to be provided to Indonesia's Bureau of Meteorology and Geophysics. The Scientific-Atlanta VSAT equipment is the communications portion of a $26 million prime contract awarded to Television Australia Satellite Systems Pty Ltd.

The VSAT system will return the data required for forecasting weather patterns, including potential natural disasters — river heights, flooding, wind velocity, drought — which not only affect the Indonesia archipelago, but neighbouring countries as well. The longer term needs are to increase the efficiency of agricultural production and transportation.

Weather forecasting in Indonesia is complicated because there are 13,000 separate islands spread over 5000km, and the terrain varies from sea level to 4000 metres. This makes the task of gathering data about weather conditions nearly impossible. The new VSAT system will transfer location-specific data needed to accurately predict the weather patterns. The system includes a 4.5 metre C-band hub station (a central collection point for all data) and 400 remote VSAT earth stations, each interfacing with data transmission equipment. Information is transmitted via a PALAPA satellite.

TELECOM TO TEST CDMA TECHNOLOGY

Telecom Australia's Research Laboratories (TRL) have signed an agreement with Qualcomm Incorporated valued at US$970,000 for Qualcomm to provide its Code Division Multiple Access (CDMA) digital cellular telephone equipment to TRL for testing

'Telecommuting' or working from home via a computer and modem, has been touted for some time as the working environment of the future — but has taken a lot longer than expected to find acceptance. However many of British Telecom's directory assistance operators are now working in this way. A slow scan digital TV camera is used to communicate with a supervisor, as shown here.

in Australia. Under the terms of the agreement, Qualcomm will provide TRL with several base stations, a switch, a number of mobile units and CDMA-specific test equipment. Qualcomm will also provide its proprietary distributed antenna for improved indoor coverage.

The CDMA equipment will operate in the 800MHz frequency band, and is scheduled to be shipped in April 1993. Once installed, Qualcomm will provide hands-on training to the Australian engineers and on-site support for the first 90 days of operation.

Initial testing efforts will focus on indoor and outdoor coverage, system capacity, voice quality, soft-handoff capabilities and power control. Trials will be conducted in several Australian cities to measure the system's performance in diverse topological environments.

According to Tony Bundrock, manager of Telecom Australia's Radio and Satellite Network Section, the trials will help to position Telecom Australia for a smooth migration to Personal Communications Services (PCS) in the future. "Proving this technology in local conditions will provide us with a window to offer advanced services as they become available, allowing implementation with minimal disruption and delay."

"CDMA is a promising technology and we're keen to establish whether it is the most appropriate option for our long-term mobile network program. We will continue to provide our customers with the best possible services in the future using the best leading edge technologies," Bundrock added.

NEWS BRIEFS

- ***TADSEM '93*** is calling for papers, videos, etc., for presentation at its 1993 Sydney seminar from September 30 - October 1. TAD (Technical Aid for the Disabled) aims to provide a forum for the exchange of information on assistive technology used in education and training of people with disabilities. For more information contact TAD, PO Box 108, Ryde 2112; phone (02) 808 2022.
- Australia's International Engineering Exhibition has revised the dates for its 'Committed to Quality' ***AIEE'93*** — it will now be held at the Royal Exhibition Building in Melbourne from May 31 - June 4, 1993. This is one week later than originally announced, to avoid a clash with the Rotary International Convention, also in Melbourne. For more information contact Thomson World Trade Exhibitions, Level 9, 140 William Street, East Sydney 2011; phone (02) 357 7555.
- ***Mobiles 1993*** will be held at the Sydney Golden Gate Park Plaza Hotel, from March 8-9 1993. It aims to give the latest information about mobile communications developments both in Australia and overseas. For more information contact I.I.R., PO Box 2133, North Sydney 2059; phone (02) 954 5844.
- ***Stanilite Pacific*** has announced the $2.5m purchase of the mobile radio business division of Queensland-based TR Services, which was previously owned and operated by Cable and Wireless of the UK.
- Standards Australia has certified ***Hypertec*** a Quality Endorsed Company, meeting the internationally-recognised ISO 9001 quality standard.
- ***Philips Semiconductors*** is holding a series of half day workshops in Sydney (March 22-23) and Melbourne (March 25- 26). The workshops will cover the elements of I^2C bus transmission, as well as programming techniques for bit and byte level 80C51 bus masters. For more information contact Philips Components, 34 Waterloo Road, North Ryde 2113; phone (02) 805 4455 or (03) 881 3677.
- ***Marconi Instruments*** has formed an alliance with the test and instrument manufacturer EIP Microwave of the US. Marconi will assume responsibility for worldwide sales and support for EIP products outside North America. ❖

FASTEST BONDER FOR TAB CHIPS

Toshiba researchers have developed a new inner lead bonding (ILB) machine for manufacturing tape automated bonding (TAB) IC's. Each lead is individually bonded (single point bonding method), and the machine can bond 20 leads per second (50ms/lead), making it the fastest of its kind in the industry.

The single-point bonding method assures accurate bonding, despite height differences among the IC's contact bumps which result both from the manufacturing process and tilting of the chip during bonding the chip — matters of increasing concern with the recent trend to larger chips.

The machine adopts a thermosonic bonding method; the chip's bumps are heated, and the leads are then individually bonded to them by pressure from the bonding tool. The bonding tool is mounted at the end of an ultrasonic horn, which emits an ultrasonic vibration to accelerate the bonding.

Toshiba's new equipment uses a newly developed lightweight bonding head with a simplified structure, including the ultrasonic horn. Gears and other mechanisms to control movement of the horn in earlier models are replaced by a direct drive method.

TAB IC's are a type of IC coated with a special resin instead of inserted into plastic packages. They have the advantage of being thin and can achieve finer lead pitches and higher lead counts than ICs encased in plastic packages.

STOP PRESS: OPTUS B2 SATELLITE 'LOST'

After what appeared to be a successful launch on December 21, the second of Optus Communications' B-series satellites couldn't be contacted by ground stations, and has been written off as 'lost'. ❖

Computer Peripheral Review:

HP's ScanJet IIp 300dpi image scanner

With the growing popularity of desktop publishing packages, high-end word processors and even spreadsheet packages with graphics capability, many users of PC's are finding a need for an image scanner. Happily Hewlett-Packard has recently added a relatively low cost 300dpi monochrome scanner to its range, which may well fill the bill.

by JIM ROWE

Until now, about the only affordable way for many PC users to feed 'hard copy' images into their computer has been to use one of those hand-held 'roller' type scanners. These can give quite respectable results, if you're careful, but they do have some limitations. One is that generally they can only scan images up to about 100mm wide; another is that it can be hard to scan an image squarely and linearly, so that you minimise 'jaggies'.

A scanner of the 'flat-bed' type, with the ability to scan images up to say A4 size, can generally get around both of these limitations quite neatly. The only problem is that this type of scanner has been considerably more expensive than the hand-held type, and quite often hard to justify as a result.

Perhaps aware of the growing need for a reasonably priced flat-bed unit, Hewlett-Packard has recently released a new monochrome model which is significantly lower in price than those previously available. Called the ScanJet IIp, it provides a basic image resolution of 300dpi (dots per inch) with a grey scale of up to 256 levels, and comes complete with an interface kit for IBM-compatible PC's plus two powerful software packages for only $2129 plus tax. It is also available with an interface kit for Apple Macintosh machines and again two software packages, for even less: in this case only $1796 plus tax. These prices are still fairly significant, of course, and rather higher than you'll pay for hand-held units. In fact they're likely to be comparable to the price of many basic PC's!

Probably the main reason for this is that scanners are a relatively low volume product — the old chicken-and-egg problem. When the volume grows, I expect the price will almost certainly fall further...

For the moment, though, the HP ScanJet IIp seems to be the most attractively priced A4 flat-bed scanner available. That's why I was quite interested to put one through its paces.

Compact package

Physically, the ScanJet IIp is compact and relatively unassuming — a fairly plain, low profile rectangular box measuring 286mm wide by 405mm deep, and only 79mm high including its hinged lid. There are virtually no hardware controls as such, apart from a power switch located near the rear of the right-hand side. A small green 'pilot lamp' is inset into the front right-hand corner, to indicate when the scanner is powered up.

At the rear of the case are the connectors, with a standard IEC three-pin captive plug for the mains input and a pair of alternative connectors for the scanner's SCSI-bus control and data output port. One is a DB-25 socket, while the other is a 50-way '57N' series connector. The only other things visible are a small recessed rotary switch, used to set the scanner's SCSI-bus address, and a capped connector used to provide power for an optional sheet feeder attachment.

Incidentally the lid of the scanner is 'double hinged', to allow it to cope with thicker items like books. It can also be swung right out of the way, for even thicker books. The optional sheet feeder actually replaces the standard lid, when it is fitted.

The ScanJet IIp's SCSI interface is designed to connect either directly to the SCSI port of an Apple Mac, or to an IBM-compatible via an interface card (dedicated) which duplicates the Mac's 'limited function' SCSI port. Hence the higher price of the package for use with an IBM-compatible, as the interface card is included. Also provided in both cases is a SCSI bus terminator, as well as the SCSI interconnect cable and an IEC power cable.

By the way an alternative version of the IBM interfacing kit is also available, for use with IBM's Micro Channel machines.

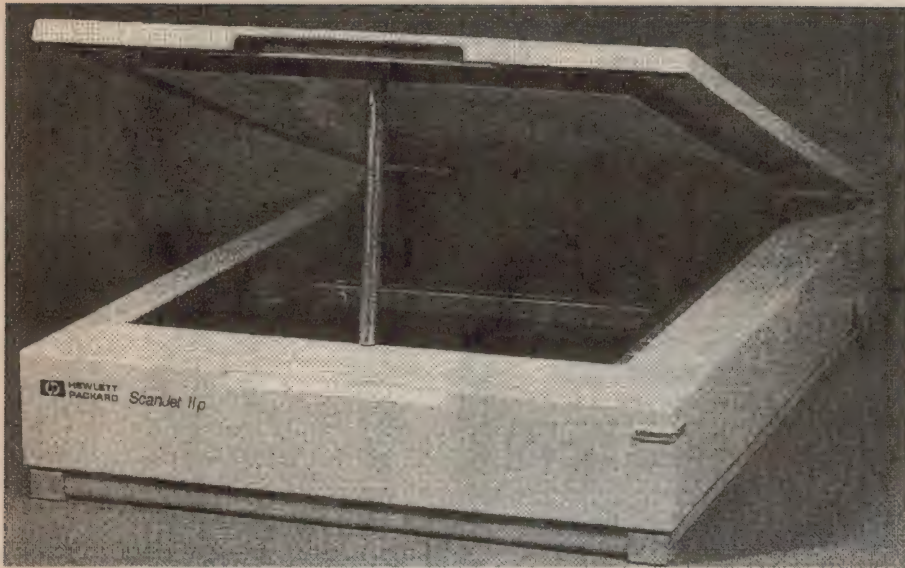
As you'd expect from the fact that it has no front-panel controls, the ScanJet IIp is controlled entirely by the accompanying software, and both the IBM-compatible and Mac versions of the scanner come complete with two software packages. The primary package in each case is *DeskScan II*, which provides all basic facilities for controlling the scanner and achieving the best scanned images. With the IBM-compatible package you also get Z-Soft's *PhotoFinish*, a very flexible image editing and pixel-orientated drawing package, while the Mac package comes with a similar package from Zedcor called *DeskPaint*. Both of the packages for the IBM environment run under *Windows 3.0* or later, incidentally.

The bottom line, then, is that the HP ScanJet IIp comes complete with all of the hardware and software you're likely to need, to get it going with most personal computers.

Trying it out

HP Australia kindly supplied us with a sample scanner and the IBM-compatible interface kit, which we installed on a 486 machine running at 33MHz, under MS-DOS 5 and *Windows 3.1*. This turned out to be quite straightforward, following the setup instructions given in the user manual.

As part of the installation, the SCSI interface card had to be plugged into a spare slot in the computer. Before this is done, however, you need to install the software and run a small utility program called



This overall shot of the ScanJet IIp scanner has been scanned by the unit itself, and then printed out on a 300dpi laser using the 'extra fine half tone' setting of the DeskScan II software. Note the small prop used to hold the lid open.

SWTCHSET. This explores your system's memory and I/O space, and nominates a base address that is both available and suitable for the SCSI card to occupy. You then turn off the power, set the card's address DIP switch for the correct address, and plug it in...

It only remains to find a suitable location on the desktop for the scanner, fit its power and interconnecting cables (with the supplied terminator fitted to the scanner end of the SCSI cable), and release the transport lock for the scanner's optical head. You're then ready to turn the power back on, and start scanning.

HP's own *DeskScan II* package turned out to be very easy to use. It comes up with the screen window shown in Fig.1, with a 'control panel' on the left and an initially blank image preview area on the right. The image area can actually be resized and enlarged, if you wish.

To begin scanning, all you have to do is place your hard-copy image in the scanner (face down), close the lid to hold it flat, and then simply use your mouse to click on the 'Preview' button, at lower left of the screen's control panel. Within 10 seconds, or less, a preview image appears in the right-hand window.

You now have a number of options, with a multi-level access scheme designed to simplify basic operation, while still allowing you to take more control over the details of the scanning process if you wish and/or need to.

Usually the first step is to specify how you want the image to be treated — as a black and white drawing, a 'black and white halftone' or a 'black and white photo'. These basic options are set simply by clicking on the 'down arrow' in the box to the right of the 'Type:' label near the top of the control panel, and selecting one of the menu options that pop down.

The first option is to treat the image as a 'line' illustration, with only black and white levels and no shades of grey; the last option is to produce a full 256-level (i.e., 8-bit) grey scale image file, for feeding into other packages; and the middle option is a direct conversion of a greyscale image to a halftone-dot version, for direct printing via a laser printer. In each case the results of your selection are displayed in the preview box.

The program itself tends to draw a 'bounding box' around what it judges to be the active or 'live' part of the preview image, but the sides of this box can be manipulated as desired with the mouse, to select whatever part you wish. Clicking on the 'Zoom' button at the bottom of the control panel then initiates a repeated preview scan, with the selected area enlarged for closer inspection.

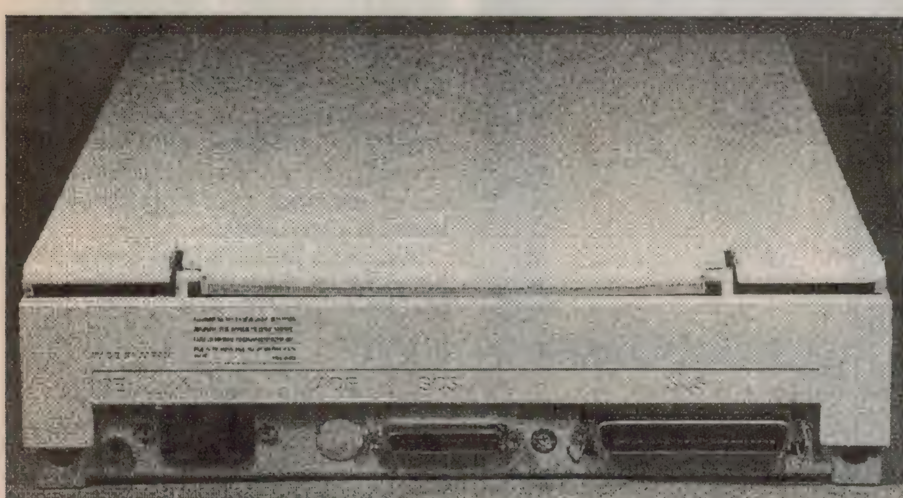
The brightness level and overall contrast range of the image can be manipulated using two horizontal 'slider bars' in the centre of the control panel, or if you wish you can get the program to select its own idea of the optimum settings, by simply clicking on the square button between the two.

A longer single slider bar allows you to set the optional scaling of the image for printout, between nominal limits of 4% and 400%.

Each of these slider bar 'controls' is adjusted using the mouse, in the manner familiar to anyone who has ever used either *Windows* or a Macintosh. There's the usual 'elevator button' and arrow buttons at each end, and in this case you also have a numerical display alongside, to guide you by quantifying your selections.

Four further buttons near the bottom of the control panel allow you to easily flip the image laterally, change it into a negative, adjust its vertical and horizontal scaling independently, or 'lock' its size.

If you want to exercise more detailed control over the scanned image, you can do so by moving down to the next level of control. This involves things like clicking on the 'Tools' menu label at the top of the control panel, which provides access to two separate mini-window 'toolboxes' — one to allow manual setting of the scan's 'highlight' (white) and 'shadow' (black) levels, and the other to allow manipulation of the scanner's 'emphasis' (contrast) law or *gamma* curve. The latter allows you to emphasise or throttle back the low,



As you've probably guessed, this rear view has also been scanned and printed out on a laser printer in the same way as the photo above. The same settings were used. In both cases 'heavy' sharpening or edge enhancement was used.

HP's ScanJet IIp

middle or high greys if you wish, to improve the image further.

In both cases this manipulation is done surprisingly easily, again using the mouse. To set the white and black levels, for example, you simply click on each button; in each case the cursor changes into a little 'cross hairs with bubble' shape, which you then move over into the preview image and use to indicate which locations are to be treated as 'white' or 'black' reference level.

The preview image then changes to show you the effect of your selection. The emphasis toolbox also lets you save custom gamma curve 'recipes' on disk by name, for rapid and convenient selection later on.

Further image manipulation and control again can be achieved by choosing the 'Custom' menu label, which pulls down a further menu giving you the ability to select degrees of 'sharpening' (edge enhancement), and select either 16 levels (4-bit) or 256 levels (8-bit) of grey scale, for saved grey-scale files. Frequently used sharpening and/or grey scale image Type 'recipes' can again be named and saved on disk, for later re-use.

You can also select an image resolution for printing, and calibrate a printing 'path' to compensate for printer and/or applications software variables, and optimise the overall image processing chain. These 'Path' recipes can also be saved on disk.

After you've manipulated your image as desired, you can either print the final version out directly, or save it to disk as a file — in one of a range of available file formats, including TIF 5.0, PCX, *Windows* BMP, EPS and so on.

My impression of *DeskScan II*, after playing with it for some time, is that it is both powerful and intuitive as a scanning controller and basic image manipulation tool. It's clear that HP's programmers have put a lot of effort into giving it this combination of multi-tiered flexibilit, and ease of use.

Initially I did have a problem with direct printing from this program; when I tried to do so, *Windows* and the machine as a whole would grind to a standstill partway through the final 'scanning to printer' operation. However after a quick call to a chap on HP's support hotline, I tried his suggestion of disabling *Windows*'s Print Manager, and the problem disappeared.

In many ways the second software package supplied with the scanner, ZSoft's *PhotoFinish* also makes an excellent choice, because it largely complements the features of *DeskScan II*. With

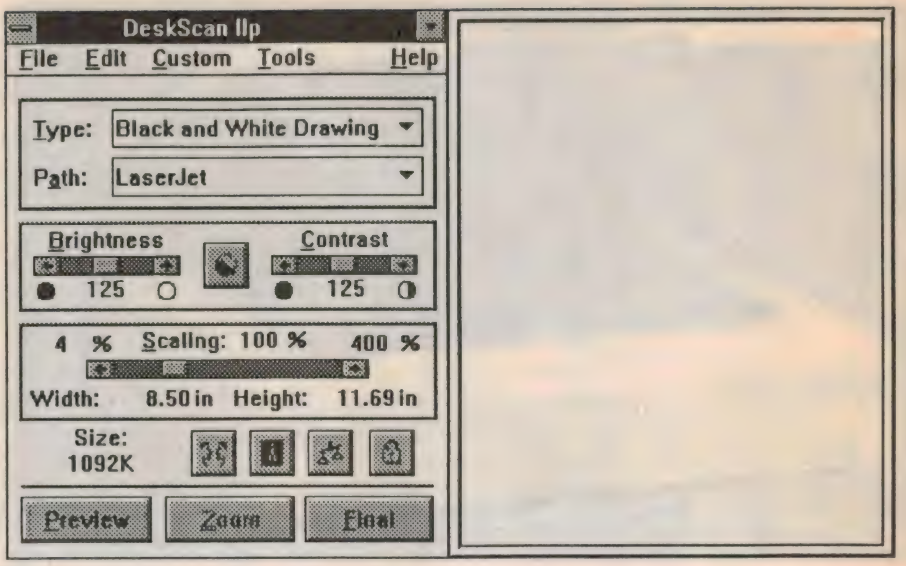


Fig.1: The basic screen window which appears when you run DeskScan II. At left is the 'control panel', with the preview window on the right.

PhotoFinish you get a very powerful and comprehensive set of retouching and editing tools, for repairing and modifying areas within an image — as well as additional 'global' tools like the ability to rotate an image through 90° (handy for those whose size and width have forced you to scan them on their side), and also the ability to rotate it through very small angles (skew adjustment) to minimise 'jaggies' on long lines and edges.

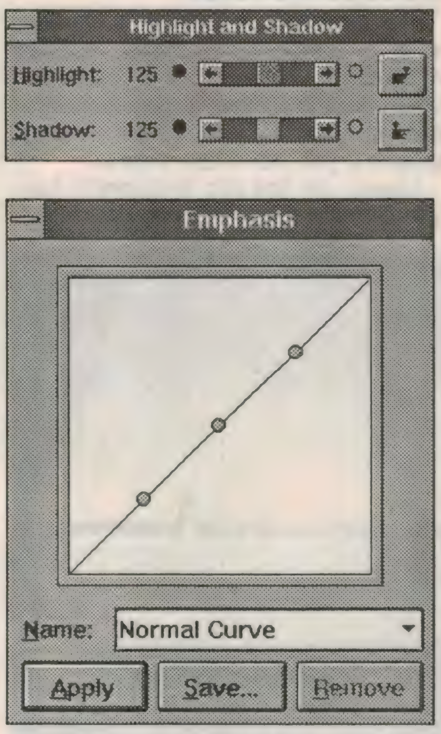


Fig.2: Two of the additional 'toolbox' windows which can be called up for further manipulation of the scanned images.

Incidentally I found that I was already quite familiar with *PhotoFinish*, without previously realising it. I had already used *CorelPaint!*, and the two appear to be very similar if not identical.

Summarising

My impression of HP's ScanJet IIp, after using it for some weeks, is that taken as a package with the software supplied, it's by no means the 'no frills' or basic model you might expect. In fact it appears to provide very close to everything one could wish in a 300dpi monochrome flatbed scanner, in terms of not only performance, but also (and just as importantly) flexibility and ease of use.

As it happens, 300dpi scanning is somewhat short of what we need in producing *EA*. However after trying out the IIp I'm keen to try out another recent addition to the Hewlett-Packard range, which is in some ways its 'big brother': the HP ScanJet IIc, which comes with the same user-friendly software but offers both 400dpi resolution and 24-bit colour scanning. If I get the opportunity to try one of these out, I'll let you know the results in a later article.

Meanwhile for those who have a need for a 300dpi monochrome scanner, the new HP ScanJet IIp package seems like an excellent choice — quite apart from its reasonable price. My thanks to HP Australia for the opportunity to try one out.

The HP ScanJet IIp package is now available at any of the Hewlett-Packard dealers. For further information on the scanner, or for the address of your nearest dealer, you can ring the HP Customer Information Centre on 131 347 (local call from anywhere in Australia). ❖

We've recently taken on a new line in soldering irons – Hakko – and they are excellent value for money offering features usually costing much more. We have the full range available, but check out the 926 adjustable temperature iron, the memory card 927 and dual station 928. If you're thinking about buying or upgrading your soldering equipment call in and discuss your requirements.

Hakko 926 Soldering Station

The Hakko 926 (above) is a super-quick heat-up (3 sec cycle) and fast recovery iron offering high quality soldering at lower tip temperatures. The built-in ceramic heater maintains temperature to within 0.5°C of the setting. Yes this is an ADJUSTABLE temperature iron covering the range from 200°C to 480°C using a full wave zero-crossing switching system. Meets MIL-STD-2000 and operates at safe 24V. Also available in ESD for antistatic environments. We stock a wide range of tips to suit. Ask for listing.

Hakko 927 Soldering Station

Incredible memory card iron. Just look at the features –

- Digital adjustment/display system using built-in microcomputer.
- Convenient memory cards for quick and simple tip temperature adjustment and monitoring.
- Accurate Temperature Adjustment and Monitoring – Simply insert the card, set the desired temperature and push the set ("S") button. Once the temperature is set, it cannot be changed without re-inserting the card.
- Temperature Memory System – The tip temperature value is stored in the memory of the built-in computer allowing you to turn the power off and on without having to reset the temperature each time.

The HAKKO 927 ESD Soldering Station is available for static safety and meets MIL- STD-2000

Solder

1.25, 0.9 and 0.71mm diameter

250 gm	$7.95
500gm	$14.95
Solder Wick	$2.95

Hakko 928 Dual Soldering Station

- Two soldering irons of different thermal capacities may be used simultaneously.
- Choose the exact irons you need for your soldering applications.
- ±0.5°C dial setting.
- Compact unit with two 926 units in one station and easy to use.
- Cost effective and practical in production using up less space.
- Super quick heat up and faster thermal recovery, permitting quality soldering at lower temperatures .
- Separate controls for each iron
- Meets MIL-STD-2000

ASK ABOUT OTHER PROFESSIONAL SYSTEMS

CODE	DESCRIPTION	TAX EXEMPT	TAX PAID
94T	Solder Pot	$195.00	$222.00
96	Solder Pot-200W 0.85kg capacity	$350.45	$399.45
152	Motor Drive for 153/154/155	POA	POA
153	Cutting/Forming for Axial Components	$1148.00	$1312.00
154	As 153 but for Axial Components 5mm	$1198.00	$1369.20
155	Cutting for Radial Components	$1324.80	$1508.80
156	Parts Feeder for 153 and 154	POA	POA
191	Thermometer with Large Digital Display	$250.00	$278.80
191-211	191 Sensors per Pack of 10	$17.25	$19.65
470	Desoldering Tool	$945.00	$1079.00
471	Desoldering Tool	$848.00	$965.40
483.1	Complete Desoldering Gun	$415.70	$473.85
485	Solder/Desolder Station with Solder Bath	POA	POA
493	Smoke Absorber	$195.75	$233.15
700C	50/60W Combi Solder/Desolderer	$1095.00	$1253.00
745	Battery Powered Iron 7.2V Operation	$160.00	$182.40
804	Glue Gun with Temperature Control	$279.00	$318.80
850	SMD Hot Air Rework Station with N-7 Tip	$990.00	$1129.00
851	SMD Station	$650.00	$741.00
883	Hot Air Gun-1000W, 1250m³/min	$194.40	$221.40
926	Solder Station - 60W Temperature Control	$159.95	$183.95
926ESD	926 Station with Antistatic Feature	$315.90	$359.65
927	Key Card Station - 60W with Digital Display	$423.30	$482.50
927ESD	927 Station with Antistatic Feature	$467.45	$532.80
928	Dual Individual Control -60W, Antistatic	$531.55	$605.85

Electrolube Service Aids

Safewash 2000 – the complete environment-friendly cleaning system

Safewash 2000 is a unique blend of biodegradable 100% ozone friendly solvents in an aqueous blend formulated to provide effective cleaning of printed circuit boards. Safewash cleans to military standards (MIL-P-28809A) using conventional methods at room temperature.

Application

- Removal of flux residues and other contaminants from printed circuit boards and Surface Mount Assemblies
- Removal of unused solder paste from screens
- Degreasing and cleaning prior to conformal coating.

Features

- 100% ozone friendly
- Non-flammable
- Biodegradable
- Removes both polar and non-polar contaminants
- Removes ionic flux residues to MIL P 28809A
- Ambient temperature operation
- Low toxicity

The Safewash 2000 aerosol offers a break through in PCB rework technology. There are a number of aerosol products on the market which either still contain CFC's, or otherwise leave a sticky residue after 'cleaning'.

Safewash 2000 uses a unique foaming action to break down a wide range of fluxes, in fact up to three times more flux types than most alternatives. Once applied, the foam action 'scrubs' the board, lifting the flux residue away from the PCB. After a few minutes the flux residues are sufficiently broken down to be rinsed away using Saferinse 2000. The printed circuit board can then be dried off using an Electrolube Air Duster or another form of forced or warm air drying.

Because Safewash 2000 uses a foaming action, manual scrubbing with a brush, which can cause damage, is not required, thereby saving money on unnecessary extras. An additional operator benefit is that Safewash does not have the citrus smell often associated with aqueous or non CFC cleaners.

Safewash 2000	
400gm aerosol	**$19.80**
Saferinse	
400gm aerosol	**$18.10**
Air Duster	
550gm aerosol	**$26.60**

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Solid State Update

KEEPING YOU INFORMED ON THE LATEST DEVELOPMENTS IN SEMICONDUCTOR TECHNOLOGY

Atari's Falcon030 uses 56001 DSP

Motorola recently announced that its 56001 digital signal processor (DSP) performs key audio/video functions on the motherboard of the new Atari Falcon030 media computer. The Falcon030 is a full scale computer that uses the 33MHz 56001 to process and manipulate compact-disc-quality digital audio and voice signals.

The 56001 operates independently of the central processor, Motorola's 68030, and completes a variety of tasks without slowing the system. Within the Atari Falcon030, it drives digital audio functions, including graphic equalisation, channel manipulation, reverberation and surround sound, all of which provide the user with professional audio effects for tasks such as video sound augmenting and recording.

The 24-bit, 33MHz 56001 processes 16.5 million instructions per second (MIPS) and performs 99 million operations per second (MOPS). It can recreate CD-quality sound because its architecture is highly parallel, and its 24-bit word width generates sound with 144 decibels of available dynamic range.

Since most analog to digital converter chips translate analog signals in the ranges of 14 to 20 bits at a time, the extra bits in the 56000 architecture allow additional calculations to be performed on these digital samples, while maintaining the input signal accuracy.

NiCad charger IC

Philips Semiconductors has introduced the TEA1100, an advanced BiCMOS integrated circuit which controls the fast charging of Nickel Cadmium and Nickel Hydride batteries. It incorporates a 12-bit digital sample-and-hold circuit which detects the charge state of the batteries using a 'currentless' dV technique, together with switchmode power supply control logic to regulate the charging current.

The TEA1100 is said to provide a highly cost effective solution to fast battery charging in a wide range of consumer, electronic data processing and telecommunications equipment. Accurate control of the charge current and charge duration, coupled with comprehensive fault protection, allows the device to maximise battery lifetime (number of charge/discharge cycles) and ensure the safety of charging operations.

Designed for charging cycles of 20 minutes or less, where charging currents of several amps can result in permanent battery damage — and a safety hazard if applied for too long — the TEA1100 features comprehensive safety features.

These include a battery over-temperature cutout, open and short circuit battery protection, and a time-out facility which turns off the fast charge current after a preset period of time.

Simple adjustments of the charging current, with automatic adjustment of the corresponding time-out period, allow the TEA1100 to be used in 'universal' chargers for use with several different sizes of battery pack.

When the TEA1100 detects that the batteries are fully charged, it automatically switches over from fast charge to a trickle charge mode. The trickle charge current, which is also programmable, can be set low enough to avoid memory effects in the batteries, but high enough to maintain them in the fully charged condition. The TEA1100 operates from a 5.65 to 11.5V supply, which is easily derived from an SMPS transformer's secondary winding.

For further information circle 275 on the reader service coupon or contact Philips Components, 34 Waterloo Road, North Ryde 2113; phone (02) 805 4455.

Fast 4Mb enhanced DRAMs

Ramtron International has announced the first in a family of 4-megabit (Mb) enhanced dynamic RAM (EDRAM) products. The family includes a 1Mb x 4-bit and 4Mb x 1-bit EDRAM integrated circuit (IC) and a 1Mb x 36-bit single in-line memory module (SIMM).

Ramtron's EDRAM provides ultra-high performance in standard page mode and static column or random DRAM operation. Each device combines a fast 4Mb DRAM array with a tightly integrated on-chip fast static RAM

Real-time clock 'wakes up' PC's

The DS1587 Serialised Real Time Clock from Dall Semiconductor is a PC compatible timekeeper capable of initiating a power-on, so that ergularly scheduled tasks can proceed without operation intervention.

In addition, the device identifies the PC with a unique 64-bit serial number laser-engraved into silicon, which can be used to identify it electronically, to establish a network node address or for maintenance.

To accomplish the wake-up, the DS1587 incorporates power control circuitry and an additional date alarm register.

When the current time and date match the date alarm value, the DS1587 activates its special power control pin that drives a solid state power switch, turning on the computer. This allows daily downloading of information from a database.

The power control output can also be used to 'kick start' the system in response to an external stimulus, such as a modem ring signal.

This capability allows a user to power

on a desktop PC from a remote location, by initiating a modem connection with a notebook computer via the telephone lines. As an example application, a user can retrieve data with a desktop computer from a hotel room in a different country.

In addition to the standard real time clock registers, the DS1587 offers a total of 114 bytes of user non volatile SRAM, along with 8K x 8 of expanded non volatile SRAM for storage of extra system configuration data.

For further information circle 272 on the reader service coupon or contact Veltek, 18 Harker Street, Burwood 3125; phone (03) 808 7511.

Programmable uC peripherals

The PSD3XX is a family of programmable microcontroller peripheral devices, designed to eliminate PLDs, memory devices and peripheral logic chips from an embedded-control design. These single-chip, field-programmable peripherals can interface without external glue logic to almost any eight or 16-bit microcontroller.

Each PSD3XX device integrates high performance programmable logic, EPROM and SRAM to provide a single chip microcontroller peripheral solution.

The major functional blocks include a simple interface to the micro-controller, two programmable logic arrays, up to 1Mb of high performance EPROM, 16Kb of SRAM, two input latches, and two 8-bit and one 3-bit programmable I/O ports. One PSD3XX can replace up to 10 individual chips, resulting in significant development time and cost savings.

The PSD3XX is claimed to be ideal for applications requiring high performance, low power, and very small form factors. Examples of applications include modem, cellular telephone, vehicle brake control, instrumentation, and computer peripherals.

The devices are available in one time programmable and UV erasable reprogrammable versions and can be configured in minutes using Waferscale Integration's PC-based, menu driven System Development Tools, and programmed using an industry-standard programmer.

For further information circle 277 on the reader service coupon or contact Zatek Components, 1059-1063 Victoria Road, West Ryde 2114; phone (02) 874 0122.

(SRAM) row register. Page mode cycle times of 15ns for random and burst reads and writes permit host CPUs to perform zero-wait-state operation at clock rates up to 40MHz without interleaving, or 50MHz and above in interleaved system designs without external secondary SRAM cache requirements.

The use of EDRAM in 80486 and other high-performance microprocessor systems is said to save power and cost, while increasing overall system performance.

The EDRAM also features an internal 2048-bit-wide bus between the SRAM cache and DRAM, allowing the cache (row register) to completely refill and execute a page read miss in a single 35ns DRAM access.

Hidden precharge and refresh add additional device and system performance. Internal write posting of 15ns helps maintain high performance when writing to a new page. Further, on-chip write-through cache architecture automatically provides continuous coherency between main memory and on-chip cache.

The EDRAM IC and SIMM products have fully latched address and data I/O's that simplify timing requirements. The devices operate from a single +5 volt power supply; all I/Os are CMOS-compatible.

For further information contact Ramtron International, 1850 Ramtron Drive, Colorado Springs CO80921 USA; phone (719) 481 7000.

Series-shunt PIN switches

Alpha Industries has introduced a new monolithic Series-Shunt Element — SSE3792. The Series-Shunt Element is a single silicon chip containing two PIN type junctions in a monolithic series-shunt configuration.

The closeness of the junctions minimises the parasitic inductance normally associated with discrete devices. This combines with low junction capacitance, and results in wideband, low loss and high isolation performance.

The thin I region and low lifetime of the element provide extremely fast switching.

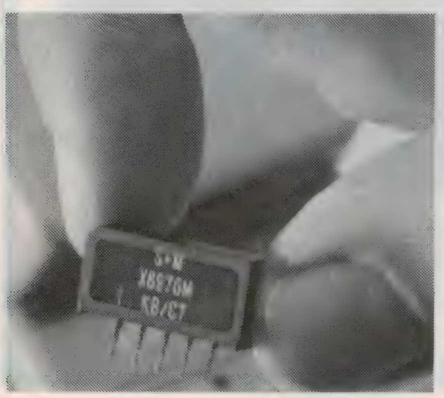
The SSE3792 is designed for use in compound multi-throw switch designs up to 26GHz. Additional shunt chips (CSB 7002-439) can also be used for added isolation.

Other features include: 0.019pF typical series junction; 0.10pF typical shunt junction; 5ns switching time; and 1.0dB loss/40.0dB isolation at 18GHz.

For further information circle 271 on the reader service coupon or contact Electronic Development Sales, PO Box 822, Lane Cove 2066; phone (02) 418 6999.

SAW filter for cordless phones

Siemens has available a new surface-acoustic wave (SAW) filter specially for cordless telephones. With a centre frequency of 49.05MHz, it reduces circuit complexity for the first intermediate frequency stage.



The new X6970M filter is part of the low-loss group. Within the 3dB bandwidth of 900kHz, the insertion loss is typically only 6.4dB, whereas adjacent channel suppression is 40dB. Apart from this special type, Siemens customers can select for their development any centre frequency between 40 and 70MHz. Input and output impedance are 50 and 2000 ohms, respectively.

For further information circle 273 on the reader service coupon or contact Siemens Electronics Components, 544 Church Street, Richmond 3121; phone (03) 420 7716.

16-bit audio for PCs

Crystal Semiconductor, a subsidiary of Cirrus Logic, has released a high performance, two chip set that brings full 16-bit stereo audio capabilities to IBM PC and compatible computers. Consisting of the CS4215 Multimedia Audio Codec and CS4131 Multimedia Digital Audio Controller, the new chips are the first in a family of devices that will address the particular needs of the emerging office/business audio market.

The CS4215 is a stereo analog to digital and digital to analog converter (ADC/DAC) that performs coding and decoding operations on audio signals within the PC environment, making CD-quality sound available on personal computers.

The CS4131 provides a digital audio interface between the CS4215 codec and the personal computer. It implements all the timer and control functions necessary to record and play back sampled digital audio at sample rates of up to 48kHz. Together, the devices offer all the advantages of both 16-bit audio sampling and 16-bit, rather than eight bit, data transfers.

By using full 16-bit audio sampling and a 16-bit ISA bus interface, digitised audio can move more rapidly thereby increasing system throughput without increasing the burden on the CPU of the PC.

For further information circle 280 on the reader service card or contact Crystal Semiconductor, 4210 S.Industrial Drive, Austin Texas 78744. ❖

Construction Project:

8051 Microcontroller Prototyping Board

Would you like to learn to use microcontrollers? Perhaps in order to play around with interesting digital chips such as 12-bit ADCs, speech synthesisers, stepper motors, keyboard/display controllers and so on... But are you turned off by the thought of having to wire up lots of bus wires before you can do anything? Then this project is for you!

by PETER BAXTER

After *EA* published my IBM Keyboard Decoder (December 1990) and the ROMloader EPROM Emulator (Jan/Feb 1992) projects, I received many letters asking about the micro-controllers used, and where more information could be obtained. I also received requests for a development board for working with microcontrollers.

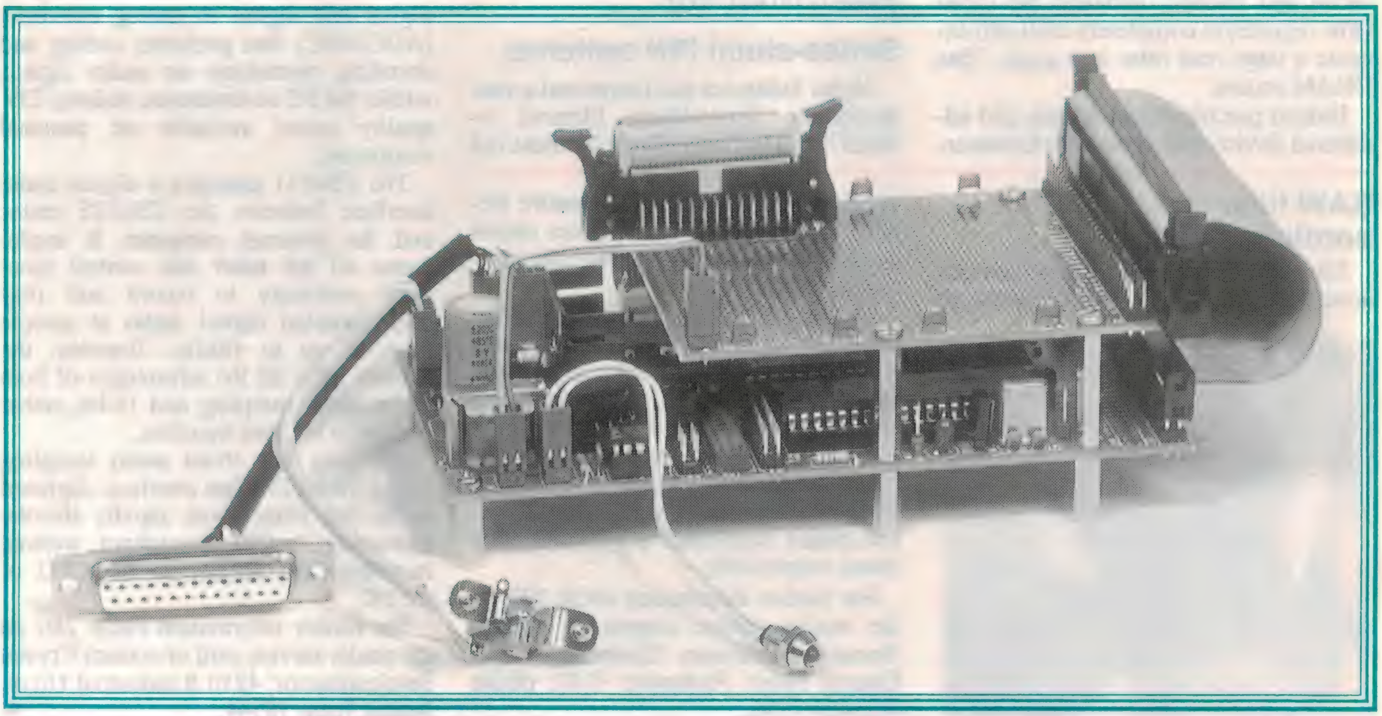
In response to these requests, I've designed the 8051 Proto-Board described here, and I believe it should prove useful to both newcomers to microcontrollers and experienced users alike. I've also included phone numbers so you can get more information.

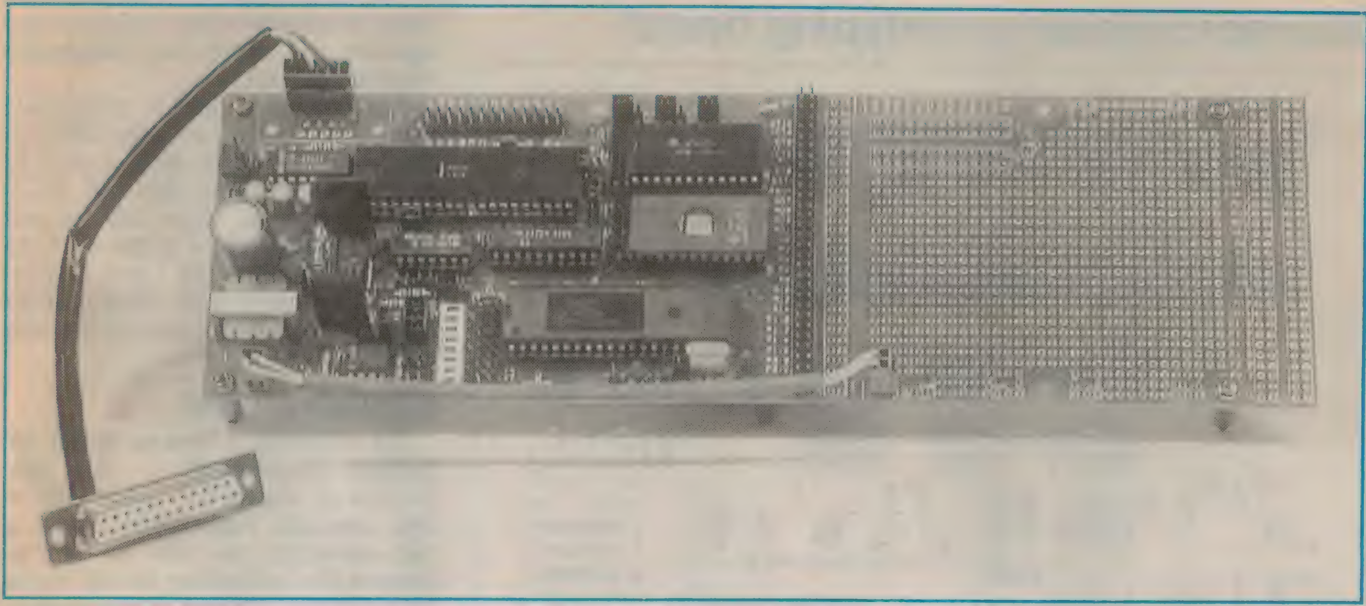
Microcontrollers

On the market at the moment are many different types of microcontroller chip. Microcontrollers typically contain a CPU, RAM, I/O ports, timers and serial communications. They are a complete computer system in one integrated circuit. Of the 8-bit types, two families are the most popular: the Motorola 68HC11 and the Intel 8051. The Motorola 68HC11 is a very capable device and is widely used. However I have come up the Intel path — through the 8080, Z80 (Zilog), 8048 and 8051 — and as a result I've based this project on the 8051.

Many people have asked me where they can get information on the 8051 family. Intel have two data books costing $25 each. The first, titled *8-Bit Embedded Controllers*, explains general hardware and software operation. Philips also offers a similar '8051 only' book for $15 plus $3 postage. The advantage of the Intel book may be in that it also has information on the 8048 family which, while a generation older, is still very useful!

I feel the second Intel handbook, *Embedded Applications* doesn't have as much to offer as the first book, especially at $25! The Intel books are avail-





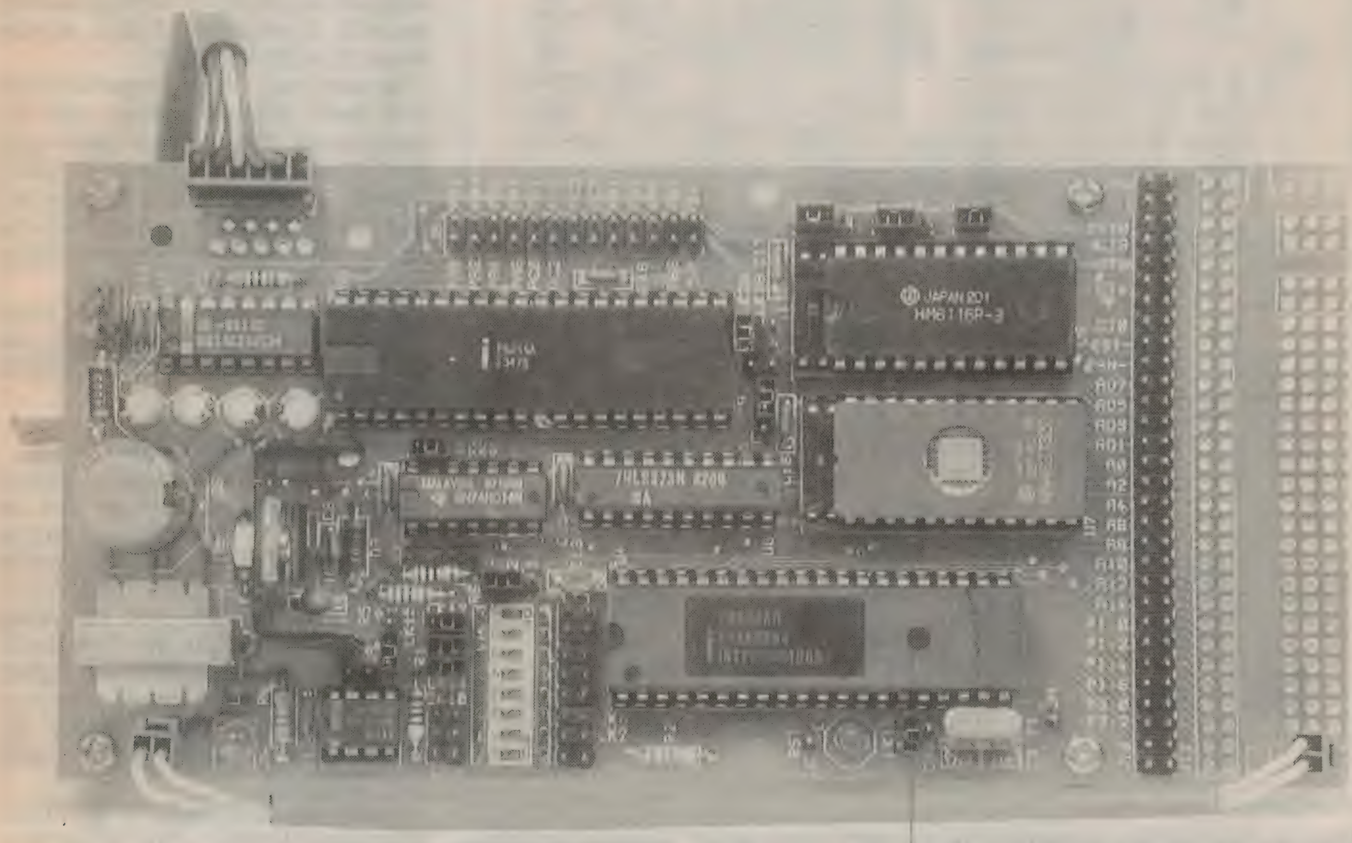
An overall view of the proto board when left as a single card, rather than cutting it into two and mounting the prototyping area above the controller section as shown at the bottom of the facing page. It can be used in either format.

able from NSD (008 335 623) and Email (02 682 3611), while Soanar (02 645 2111) should be able to supply the Philips book.

There are two other books I can suggest. *The 8051 Microcontroller* by Kenneth J Ayala (West Publishing, 1991; ISBN 0-314-77278-2) includes an assembler and simulator program on disk, along with the book itself.

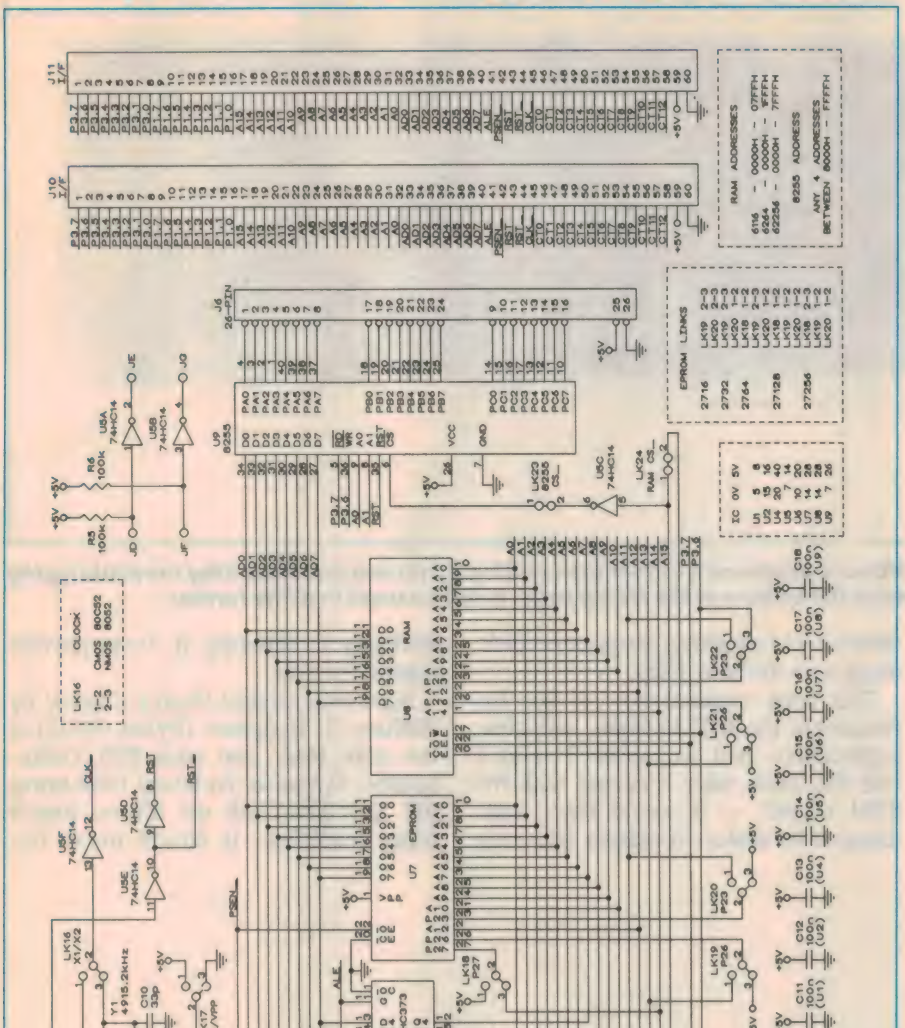
This book explains how to use the features of the 8051 in depth, with clear explanations and examples. I wish I had this book when I started with the 8051 myself — it would have made things a lot easier! If readers have any difficulty in obtaining it, I can provide copies for $50.

Mastering Digital Device Control by William G. Houghton (Sybex 346-5) is the other book, and costs $50. Unfortunately Dymocks Technical Bookstores (02 224 0444) tell me it's no longer being published. It covers many dif-



A close up of the controller or 'microprocessor engine' section of the board, to guide you in wiring it up. Use this photo in conjunction with the overlay diagram shown later.

Microprocessor prototyping board



Here is the complete schematic for the 8051 proto board, showing all of the options that the author has provided to cope with various kinds of microcontroller chip, RAM chips, and EPROMs.

ferent microcontrollers, and has more interface and application information than the first book.

You will also find a tremendous amount of application information in data sheets for other devices such as ADCs, DACs, EEPROMs and PALs. Many data books show how to connect up specific chips to the 8051, as well as to other micros. Often they include some source code. Most of these are proven circuits that you can use with confidence.

Software support

You will need a cross-assembler for software development. I have discovered a shareware 'Table' driven cross-assembler called TASM. It has a main executable program as well as separate files containing lookup tables for assembling different microprocessor source codes.

It has tables for 8080, 8085, Z80, 8048, 8051, 6502, 6800, 6801, 6805, 68HC11, TMS320 and others! You could create your own table for another micro if you like. It is a shareware program so the registration fee is well worth it! Do register if you're going to use it, though. I have.

I assume many constructors will be new to the 8051, and may have trouble understanding some of its programming methods. I certainly did after moving across from the Intel 8048.

To help you, I have prepared a disk with some software routines that are ready to use. These include serial communications, menu programs, EEPROM control, a proto-board test program, XMODEM transfer, Intel and Motorola Hex conversion, RAM contents display and some simple maths routines.

It may save many hours of time. TASM will also be provided on this disk, as you might like to see what it's all about.

Proto Board hardware

The problem with most computer projects is that you have to wire up the tedious microprocessor section before you get to the part you're really interested in.

Generally, this puts you off doing what you wanted to do. Essentially, this project is a 'microprocessor engine' — around which you can develop your own application. Simply solder the project together and get on with what you want to do!

A PCB has been produced that offers tremendous flexibility. Not only is there the standard support for a ROMless 8051, but there is extra RAM, I/O ports,

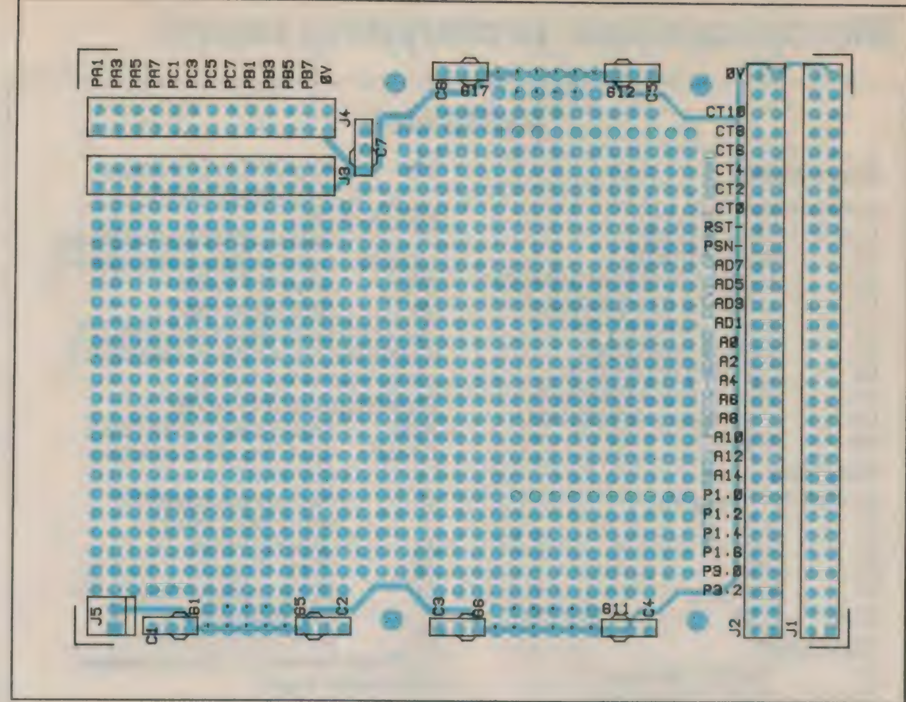
EEPROM, DIP switches as well as the prototyping area.

For those who are interested, I designed the PCB with OrCAD/PCB, which is a fairly basic yet costly PCB package. Precision Graphics (02 948 5999) converted the package's Gerber files to photoplots. East Coast Printed Circuits (02 982 1377) produced the boards for me. I designed the board so that you shouldn't need to cut tracks. (It's a beautiful board, don't destroy it!) Most things can be simply linked in or linked out, and most signals are available from the 60-pin interface connector.

The board uses an 8032 (ROMless 8052, which is an advanced 8051) microcontroller (U4), with external program memory in U7. This program memory can be a 2716, 2732, 2764, 27128 or 27256 EPROM, or one of their variants. Selecting EPROM type is done through the setting of three links: LK18, LK19 and LK20.

An RS-232 serial port is available using a MAX232 chip or clone, U2. (Hint: the Intersil ICL232 and National Semiconductors DS14C232 are half the price!) Provision for a 9-pin female DB connector J1, or 6-pin in-line connector J2, is included on the board for connection to other computers.

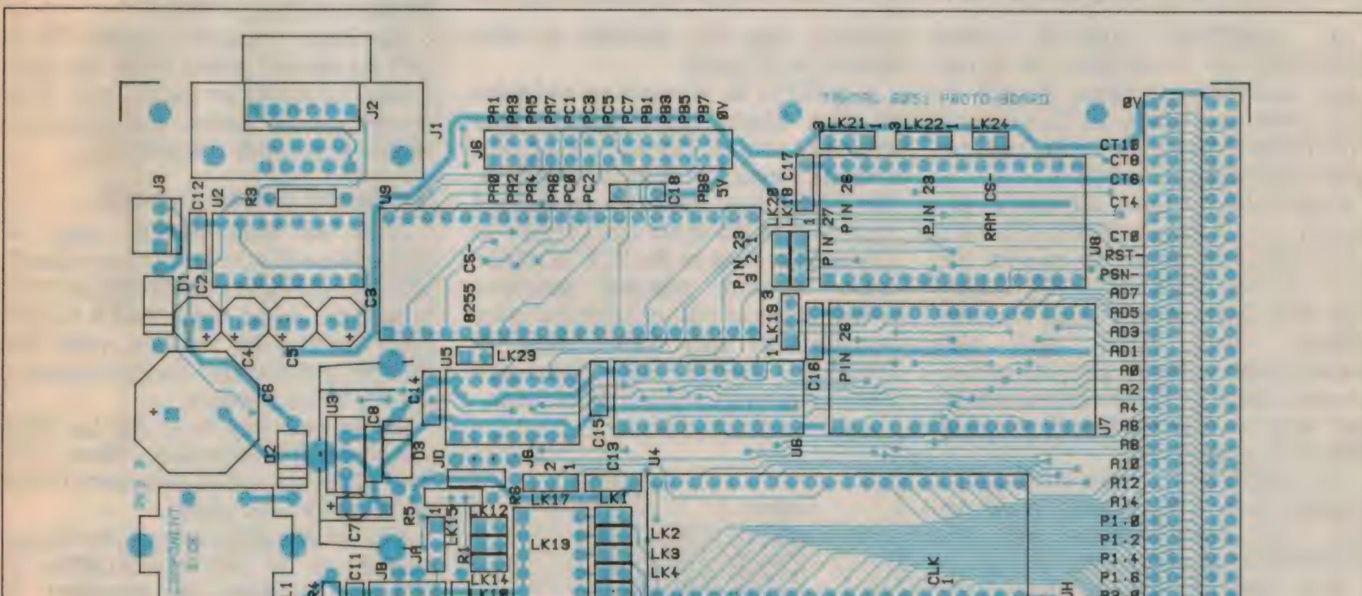
The 6-pin connector could be wired up to a standard DB-25 connector. The pull-up resistor (R3) on the RS-232 CTS line prevents serial communications being disabled should a three-wire only (TXD, RXD and GND) cable be used.



As you can see from this overlay, the prototyping section of the board has very little on it, apart from the connectors used to interface with the controller section.

The board can be run from a plug pack rated at 300 milliamps or greater, but make sure you provide for the prototyping area's current consumption. J5 has been included to supply clean, low impedance power to the prototyping area, instead of drawing high (and noisy) currents through the 60-pin expansion connector. A small choke has been included in series with the DC input (L1) to reduce noise and spikes getting onto the power supply rails.

While an LM7805 regulator is quite satisfactory, better performance can be obtained from an LM340T-5.0. Also a 220nF tantalum capacitor is preferred for C7. On J3, the main power input connector, a reset line is provided should you wish to have a remote reset or power supply supervisor.



This overlay is for the controller section of the 8051 prototyping board, as you've probably guessed already. Note the many small header blocks used to programme the board for various chip options.

Microprocessor prototyping board

PARTS LIST

Main board

Semiconductors

D1,2,3	1N4001 diode
U1	9346 EEPROM
U2	MAX232, ICL232 or DS14C232
U3	LM340T-5.0 (or LM7805)
U4	8032H microcontroller
U5	74HC14 or 74LS14
U6	74HC373 or 74LS373
U7	2716 to 27256 EPROM
U8	6116, 6264 or 62256 RAM
U9	8255 PPI

Resistors

All 1/8W 10% tolerance:

R1	4.7k
R2	8.2k
R3	10k
R4	560 ohms
R5,6	100k

Capacitors

C1	10uF 6V electrolytic
C2,3,4,5	22uF 16V electrolytic
C6	2200uF 16V electrolytic
C7	220n tantalum or ceramic (0.1" or 0.2")
C8,11-18	0.1uF monolithic ceramic (0.2")
C9,10	33pF NPO ceramic (0.1")

Miscellaneous

PCB	Printed Board, 150 x 78mm
J1	DB9 Female socket, right angle PCB mount with mounting screws
J2	6-pin connector base
J3	3-pin connector base
J4,5	2-pin connector base
J6	26-pin DIL Bergstrip
J10	60-pin DIL header
J11	60-pin DIL header socket with ejection levers
LK1-14,23,24	2-pin Bergstrip and jumper link
LK15-22	3-pin Bergstrip and jumper link
SW1	8-way DIP switch
Y1	4915.2kHz crystal

Jaycar HH8504 heatsink with 3mm bolt, washer and nut; 4 x 25mm spacers; 6 x 12mm bolts to suit spacers.

Development Board

PCB	Printed board, 103 x 78mm
C1-C7	0.1uF monolithic ceramic (0.1" or 0.2")
J1	60-pin header sockets with ejection levers
J2	60-pin Bergstrip
J3	26-pin Bergstrip
J4	26-pin header socket with ejection levers
J5	2-pin connector base

2 x 60-pin headers; 2 x 26-pin headers; ribbon cable to suit.

Note to constructors

The author can provide the following parts, for those wishing to build this project:

'8051-Proto' double-sided PCB........	$30
Intel P8032AH microcontroller........	$ 8
Software disk (1.2M 5.25" DOS).......	$15
The 8051 Micro-controller Book....	$50
Packing and Postage..............	Add $ 5
for Overseas Airmail.............	Add $ 5

Send your requirements to:
Tantau Australia
PO Box 1232,
Lane Cove NSW 2072
Phone: (02) 878 4715

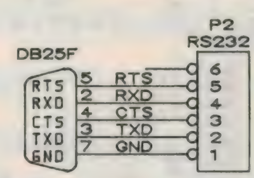
A NMC9346 1024-Bit serial EEPROM, U1, is included as it can retain non-volatile settings, is small in size, costs only about $4 (from Geoff Wood Electronics, 02 428 4111) and requires only three control lines.

Resistor R1 is a safety measure as discussed in National Semiconductor's EEPROM data sheets, to prevent the 8051 and the EEPROM's 'DO' outputting at the same time, causing line contention. The board can also accommodate other EEPROMs as U1, so pins 6 and 7 go to connection posts as they may need to be directly wired to other 8051 port lines.

DIP switches of various sizes can be installed in the SW1 position, providing that they don't conflict with the EEPROM or expansion bus.

With computer projects, there is always a need for more I/O port lines. Having external program memory (U7) takes away two 8-bit ports (Port 0 and Port 2), which could have been very useful for general I/O. However the inclusion of an 8255 programmable port interface chip U9, provides us with another 24 I/O ports.

The 8255's 24 I/O ports go to header J6. This 26-pin header can be wire wrapped to the prototyping area or have a socket connecting it to another PCB. The 8255's four addresses are located repeatedly in the upper half of the 64k address bus. Data on the 8255 might be found in many practical computer project books as well as Intel and other manufacturers data books. Also try Technical College and University Libraries as well as CO-OP Bookshops.



Finally, here is the interconnection information for wiring the 6-pin connector to a DB25 female.

Provision has been made for an additional static chip (U8), for projects requiring additional memory. This can be either a 6116 (2K), a 6264 (8K) or a 62256 (32K). Any one of these can be selected by links LK21 and LK22. The RAM address starts at 0000H going up to 07FFH, 1FFFH or 7FFF depending on the type used. Links LK24 and LK23 either disable the RAM and 8255 (respectively), or allow you to rewire them to another address.

A clock line has been provided for prototyping (pin 45 on J10, J11), but it must be set up correctly to work properly. The P8052AH chips that I can supply are NMOS devices and internally drive the X2 crystal pin, so LK16 must be set to X2. Should you use a CMOS device such as the P80C52AH, then clock link LK16 will need to be set to X1 as CMOS devices drive X1. You'll need to read the data book!

The prototyping area as supplied is an extension of the main computer board section, as experimenters may want their project laid out flat.

However it can be cut or guillotined off, and then piggy-backed onto the main computer section if you wish. The connections can be made via the 60-pin expansion bus, the 8255 I/O ports or both. There is also a connector available for power connection from J5.

On the solder side of the prototyping area, tracks join various pads together to make interconnection easier. The power supply rails go around the perimeter of the board for easy access.

The inner connection points G1 to G17 are ground points, while the outer connection points are for +5 volts. Wire wrapping to the headers makes most assembly work quick and reliable.

Software development

There are three specific ways of developing software for the proto-board. The first is to burn an EPROM, install it in the proto-board, test it, find it doesn't work, modify the program, erase the EPROM and then start the cycle again. I did this for many years!

The second way is to use an 8051 microcontroller emulator. These cost from $1500 up, which puts them out of the range for most people.

A more affordable way of developing software is to use my ROMloader EPROM Emulator, as described in *Electronics Australia* for January and February 1992. This project plugs into the EPROM socket on the proto-board and allows you to download data from your computer's serial port into a RAM that simulates an EPROM.

I suggest that you read the articles for this earlier project, as it gives a brief insight into the 8051 as well as microcontroller development. PCB's are still available for this project, if you want to build it as well.

Construction

A high quality double sided, plated-through hole PCB with a solder mask and component overlay has been produced for those wishing to build this project. Construction should be fairly straightforward. I suggest that you use IC sockets throughout.

Try to avoid making the links from individual pins, as it is very difficult to keep them straight. Heatsink paste should be used between the regulator and the heatsink.

Obviously you don't need to install all of the components to develop any particular project. Just install the parts that you need. There are many links on the board, and you may choose to hard wire these. I suggest that you do this on the solder side, so that they can be easily changed in the future.

My original concept was for the prototyping board to be mounted on top of the computer board, using long headers and header sockets. Unfortunately the 60-pin connections are very tight and connection and disconnection requires a lot of force.

It does become a bit easier after a while, though not much. (It started out as a great idea!) If you still want to do this, Geoff Wood Electronics have connectors that are suitable. What I am now suggesting is that you use IDC headers, ribbon cable and header sockets with ejection levers. The ejection levers will make removal much easier and prevent bent header pins.

I have to warn you that 60-way ribbon cable will be difficult to get and expensive. I used two 30-way pieces and carefully crimped them into the header using a vice. Vero-board or other strip-board can be substituted for prototyping board area should you wish to save this for another project.

The future

I have a variety of other projects in mind based on this Proto-Board. These include an EPROM programmer, a GPIB to serial interface, a PAL programmer, a microcontroller programmer for 8748 and 8751 chips and a keyboard wedge.

No doubt many of you already have ideas of what *you* want to use it for. So this isn't the end, it's just the beginning! ❖

NEW PRODUCTS

Voltage reference standard

A 10V four cell direct voltage reference standard that allows a user to maintain a standards laboratory reference, and at the same time transport any one of the four cells to different locations to establish traceability or to make intercomparisons, is now available.

The new reference standard, called the Fluke 734A, consists of four mechanically and electrically independent model 732B DC standards in a rack width enclosure, with each 732B providing both 10V and 1.018V outputs.

Long term instability of each 732B will not exceed +/-0.3ppm/month and +/-2ppm/year. With time characterisation calibration (option 732B-100), the traceable accuracy at 10V is maintained to within +/-1.5ppm for one year.

The 10V output of each 732B reduces the effects noise and thermal EMF's on extremely precise measurements, and simplifies use compared to conventional saturated standard cells. At the same time, the 1.018V output makes it possible to replace saturated standard cells in many applications.

Each standard is small, light and rugged to simplify shipping, and includes a built in battery and charger. To protect against AC power loss and to accommodate shipments over long distances, battery life is more than 72 hours and can be extended to 144 hours with an optional auxiliary battery. There is no effect on the output when switching between AC and battery power.

The 734A is designed for primary and secondary standards laboratories to establish direct voltage traceability to national standards authorities, and to transfer the traceability to service or production facilities.

Three 732Bs are intercompared to establish the voltage reference, while a fourth 732B is used to transfer that reference value to other locations. Statistical methods may be used to reduce the uncertainty of the reference.

For further information circle 242 on the reader service coupon or contact Philips Test & Measurement offices in each state; phone (02) 888 0416.

New power resistor line

Ohmite has announced its new technology PECOS power resistors, and Power chip line of alumina substrate thick film resistors.

The PECOS product is a thick film resistor constructed on a porcelain enamel coating on steel substrate, and

4-channel 175MHz digital oscilloscope

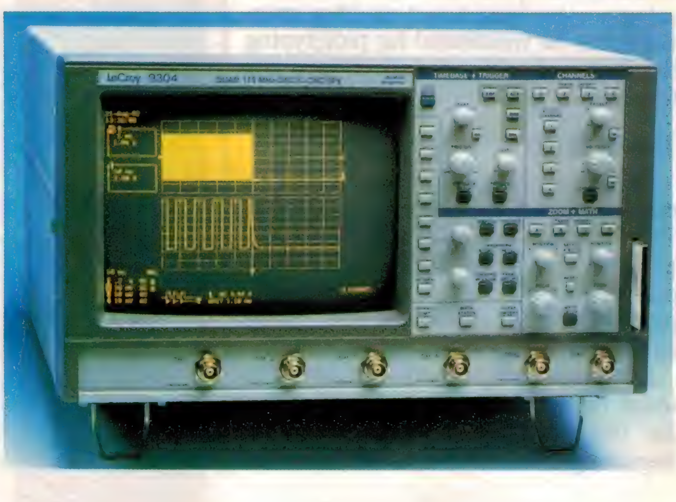
LeCroy has introduced a new digital oscilloscope that offers quad-channel capture and analysis for signals up to 175MHz in frequency. The new Model 9304 also features ultra-fast signal processing, making a processed trace look like a live one.

Each of the four channels uses high-resolution 'flash' ADCs, which digitise single-shot events at rates up to 100MSps. Repetitive waveforms are digitised at 4GSps. With a Fast Fourier Transform package installed, real-time processing is possible. Providing 10K of memory per channel, the Model 9304 samples waveforms up to 10 times faster than an oscilloscope with 1K of memory. The instrument's long acquisition memories ensure excellent timing resolution, to reveal the signal details on any timebase setting. Live, stored or processed waveforms can be expanded up to 200 times for maximum time resolution.

An optional memory card system — using a DOS compatible RAM card — can be added to LeCroy's new oscilloscope. It is ideal for applications requiring high-speed data logging and non-volatile waveform storage. Currently, up to 2MB of information (waveforms or instrument settings) can be stored on a single card.

The Model 9304 was designed to be the workhorse for demanding general purpose applications requiring multi-channel waveform recording. Typical applications include power electronics, colour monitors, digital systems and automotive industry.

For further information circle 241 on the reader service coupon or contact Scientific Devices Australia, 2 Jacks Road, South Oakleigh 3167; phone (03) 579 3622.



features a thin profile, with low inductance. It is ideally suited for switch mode power supplies and other applications where space is an important consideration.

The resistors are available in 10, 20, 50 and 100 watt standard sizes, and in 1% and 5% tolerances with values from one ohm to 250k. The high power density of these units enables power dissipation of 20 watts per square inch, which is claimed to be two to three times the capability of resistor products currently available.

Ohmite's Power Chip products have the same thin profile as their PECOS brethren, but are lighter in weight and lower priced.

They will dissipate 10 watts of power per square inch, and are available in 5, 7.5, and 10 watt standard sizes. Standard values are from one ohm to 250k in both 1% and 5% tolerances.

For further information circle 245 on the reader service coupon or contact Crusader Electronic Components, 73-81 Princes Highway, St Peters 2044; phone (02) 516 3855.

Communications interceptor

The Optoelectronics Communications Interceptor product line has another addition — the pager sized Model R20 AM Communications Interceptor, a modern version of the crystal detector radio with a microwave diode and transistors replacing the chunk of galena.

A 10 LED bargraph provides a relative signal level display using 3dB steps, for all RF signals that are detected. The frequency range covered is from 0.5MHz to over 2.5GHz.

The detected audio output is amplified and processed using sophisticated automatic level control circuitry, and an earphone can be used to monitor the detector output.

Portable 200W AC inverter

Selectronic Components has just released the latest model in its INVERT-A-POWER Silver Series range, the Series 200. The new model has been designed and built to suit a wide range of applications such as remote use of test equipment, data loggers, computers and tools, back-up power, off-road work, solar power systems, computing, caravanning and boating, etc.

Providing 240 volts AC from a battery source, this rugged portable inverter provides continuous power up to 200W with intermittent output to 200W. Its 'most asked for' features include demand start, overload and reverse polarity protection. LED indicators on the front panel show the reason for overload or shutdown.

For further information circle 243 on the reader service coupon or contact Selectronic Components, 25 Holloway Drive, Bayswater 3153; phone (03) 762 4822.

The R20 AM Interceptor can be used to check two-way radios for RF output, make RF signal strength measurements, locate stuck transmitters, test microwave ovens for leakage (even microwave ovens within the radiation leakage standards will indicate on the R20), locate RF listening devices (bugs), and listen to any AM modulated signal including CB and aircraft two-way transmissions.

For further information circle 247 on the reader service coupon or phone Optoelectronics in the USA on (305) 771 2050, or fax (305) 771 2052. ❖

Silicon Valley NEWSLETTER

Silicon Valley looks to benefit from Clinton

Silicon Valley, that bastion of Republican conservatism, is bristling with enthusiasm about the election of Bill Clinton — whose campaign they supported with unprecedented vigour. On the eve of the election, life-time Republican Party member John Sculley was prominently featured in a 1/2 hour Clinton commercial telling the viewing public that President Bush lacked a sound strategy for growing the US economy.

Now, Silicon Valley is looking forward to what will probably be an open door policy to the Oval Office, where Clinton is expected to quickly turn a number of his high-tech campaign promises (outlined in his technology industry policy) into new US policy and law. These include:

- Appointing Vice President Al Gore as the 'Technology Policy Zsar', overseeing the development and implementation of programs aimed at stimulating America's high-tech industries. (Gore is a 'tekky', owning three personal computers, one a laptop on which he wrote his recently published book on the environment).
- Redirecting US$7 billion of the US$76 billion federal research budget from military programs to those that will have application in the commercial markets.
- Setting up a 'National Technology Bank', to help companies obtain access to leading edge technology developed and owned by the government.
- Quickly implementing the development and building of a nation wide digital communications network, which some believe will do as much for the US economy as the interstate highway network. The network would link thousands of commercial, academic, and government research centres. It will also be extended to every home and office, allowing consumers to benefit from a host of new digital data and entertainment services.

Part of the US$60 billion Clinton has budgeted for his 'Rebuild America' programme will be used to help settle industry disputes over technology standards, creating a level playing field. A common standard would make it easier for a vast number of companies to offer a multitude of new services, such as digital entertainment libraries to deliver rental movies into a person's living room.

Steve Jobs' firm NeXT has announced that its Nextstep graphical user interface, which has been very popular with users of their computers, will shortly be available for use on 486-based PC's. It is expected to hit the market just before Microsoft's new Windows NT, and is hoped to give NeXT an entry into the mass personal computing market. Nextstep sits on top of the Unix operating system.

Young retires as H-P chief

He took his company from a US$1.4 billion company that was mostly engaged in selling scientific and electronics instruments in 1977, to a world leader in computer technology with expected 1992 sales of more than US$16 billion. But a few weeks ago, surrounded by a group of his closest associates, John Young retired as president of Hewlett-Packard at 60, an age at which the company's progressive 'The H-P Way' employment policies demand executives to step aside.

Along with Young, who served H-P for 34 years, second-in-command Dean Morton also retired as chief executive officer and chief operating officer.

Apart from a few disappointing quarters, Young's tenure as president has seen a pattern of continued rapid growth. And the company that was once noted for producing often costly over-engineered electronics systems has transformed into a worldwide leader in some of the most price-competitive computer and peripherals markets. It dominates the desktop printer field and has leading edge products in workstation and minicomputer markets. As for the future, Young has been tipped as a potential candidate for Secretary of Commerce under President Clinton. In September, Young made nationwide headlines, along with Apple chief John Sculley and a host of other lifetime Republican business leaders in Silicon Valley, for endorsing Clinton and helping him formulate a new high-tech industrial policy.

Young so far has laughed off any suggestions of a Washington career, although he certainly has learned his way around DC as chairman of the Presidential Council on Competitiveness.

Machine zaps toxic waste

A Silicon Valley start-up has licenced top-notch electron beam technology from the Lawrence Livermore National Laboratory to break down toxic waste materials into water, carbon-dioxide, salts, and other environmentally innocent molecules.

Zapix Technology in Santa Clara said it had struck a deal with the premier centre for nuclear weapons development to use some of its 'treasure trove' E-beam technology to develop mobile commercial toxic materials clean-up systems. The technology works quite simply. When a high-power electronic generator/accelerator bombards large complex toxic molecules with an intense dose of high-energy electrons, they break down into smaller molecules, mostly composed of water, carbon dioxide and salts.

Zapix said early tests of a prototype system has shown the E-beam system to be far more efficient and environmentally sound than competing methods. And in many cases, much less costly.

"It is a final solution; the waste is gone forever," said Peter Schonberg, president of Zapix.

The LLNL lab has developed and used the high-energy electron beam technology in its hydrogen bomb research and development program.

The idea for this commercial application originated with Steven Mathews, a senior physicist at the Livermore Lab. Mathews tried out his idea at the lab last year, in trying to clean up toxic waste from an underground refrigeration system which had leaked into groundwater. He used an accelerator built for the lab by Schonberg Radiation in Santa Clara. Schonberg was so impressed with the results of the test it formed Zapix as a subsidiary to explore the technology.

Zapix said it hopes to have a fully operational prototype system ready by February. The system would fit within a tractor-trailer rig so that it can be taken to almost any toxic waste site.

Zapix is trying to raise US$3-6 million to finance the development and production set-up for the clean-up systems.

Korean firms 'dumped' DRAMs

Korea's three major DRAM memory manufacturers have dumped their products in the US market, selling their chips by as much as 87% below market value, according to a ruling by the US Department of Commerce.

As a result of the ruling, Samsung, Goldstar and Hyundai will have to pay substantial anti-dumping duties on the chips they ship into the United States. The duties take effect immediately in the form of a bond the firms will have to post. Permanent anti-dumping duties will go into effect following a final evaluation by the International Trade Commission, which could result in slight changes in the dumping duties.

The ruling came less than eight months after Idaho-based Micron Technology filed a dumping complaint against the ITC, accusing the Koreans of selling DRAMs below cost. The DoC said the worst offender had been Samsung which recently overtook Toshiba as the world's largest DRAM manufacturer. Samsung was found to be selling US$10 DRAM chips for as low as US$1.30. Goldstar was found to be selling its memory chips at 52% below market value, while Hyundai Electronics was dumping at a 6% rate.

It is the second time the US has found foreign companies guilty of dumping DRAMs. In 1986, also acting on a complaint filed by Micron, the ITC found that most of the major Japanese DRAM firms had systematically been dumping memory chips in the US, a practice that caused 11 of the 14 US DRAM makers to fold or get out of the market.

The 1986 complaint led to the first US-Japanese Chip Trade Agreement, and subsequent sanctions when dumping continued unabated.

US blocks joint R&D with Japan

In an unprecedented move, the outgoing US government has turned down invitations from Japan and Europe to join in several major technology research projects, as the US fears the programs would only serve to increase the flow of critical US technology to foreign trading partners. The Bush Administration acknowledged it had blocked government researchers from participating in the joint projects.

One of the projects proposed by Japan involves a US$1 billion, 10-year effort to develop 'intelligent manufacturing systems' — flexible factories that could quickly change production operations with the help of advanced robots and computers.

Another project calls for scientists from around the world to cooperate on several advanced artificial intelligence projects, which would create computers that could understand speech, interpret facial and other body expressions, and teach themselves to 'think'.

Short of admitting fear that foreign companies would take unfair advantage of the technology in question, the Bush Administration said it cannot authorise participation by government researchers because it does not support the idea of industrial policies designed to help specific industries. But there is no mistake about the real reasons for the US action.

"The Japanese have always targeted and harvested the specific things they want. There is no track record of where the Japanese have offered something out of the goodness of their hearts," said Deborah Wince-Smith, assistant secretary of Commerce for technology policy.

Critics charge the US is missing out on an opportunity to learn about Japanese research methods and establish relationships with some of the world's most efficient manufacturers. Ironically, the two Japanese programs were a direct result of worldwide criticism, particularly from the US that Japan had not made an effort to share some of its technical expertise with other countries.

The Japanese have assigned a high priority to intelligent manufacturing, with which they hope to offer consumers unprecedented choices in ordering customised products. In particular, buyers around the world could walk into a Honda dealership and custom design their own car — including interior and exterior colours and materials, interior comfort and entertainment features.

The dealership would send the specs to a central processing centre, which would start ordering the desired parts from various vendors. A few weeks later, the customised vehicle, at only a modest premium, would arrive at the dealership for the customer to pick up.

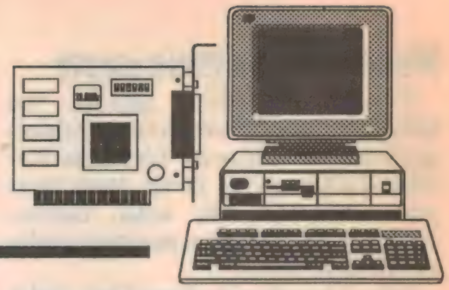
DRAM prices jump after dumping ruling

DRAM prices in the United States jumped an average of 20% the day after the US Commerce Department ruled that Korean DRAM producers have been selling their chips in the US market for 6-8% below market value.

Prices of 4Mb DRAMs jumped $2-4 on the spot market, with prices ranging from US$12-14, up from US$10 the day before the DoC announcement. Industry analysts said DRAM prices probably won't return to their low levels any time soon. Besides the impact of the dumping ruling, the DRAM market in general is starting to feel the impact of the tremendous popularity of the Microsoft Windows program.

Because of the high DRAM demand Windows puts on a system in order to function optimally, many users are purchasing DRAM upgrade kits. ❖

Computer News and New Products



Integrated colour computer/projector

A line of integrated, high resolution, full colour, portable LCD data projectors from In Focus Systems, the LitePro series consists of the LitePro and the LitePro LS.

These products eliminate the need for an overhead projector and LCD projection panel to deliver electronic presentations by providing these functions in one compact, lightweight unit. The LitePro LS also contains a built-in presentation manager system which removes the need for connection to a computer.

The LitePro includes a colour LCD panel, a projection light source and optics for real time computer graphics and data. With the presentation management system of the LitePro LS, the user can capture any personal computer image compatible with software applications using DSO, OS/2, Windows 3.0 and Macintosh operating systems. More than 40 images can be stored on a single 3.5" disk.

The series has a high quality integrated optics system, provided by a distortion-free 216mm lens and a bright 250 watt light source which simplifies operation by avoiding the need for complex alignment and convergence adjustments. There is an optional dioptre lens that can be fitted for displaying large images at close projection distances.

The unit's TSTN (Triple Supertwist Nematic) colour LCD technology is capable of 640 x 480 pixel resolution, and supports up to 4913 richly saturated colours. This allowed the projector design to be compact and lightweight, providing portability. Both products are compatible with IBM compatible and Macintosh personal computers without external adaptors.

For further information circle 162 on the reader service coupon or contact Electroboard, 275 Alfred Street North, North Sydney 2060; phone (02) 957 5842.

21" Brilliance monitor

Philips has introduced a new top-of-the-line 21" model in its high performance Brilliance monitors range. The Brilliance 2110 is an autoscan colour monitor that supports resolutions of up to 1600 x 1280 — today's highest resolution standard in the field of high end personal computers and workstations. At the same time, this model has an extended horizontal scanning frequency range of up to 82kHz, supporting the high refresh rates which are essential to obtain a stable, flicker-free display with such large screen sizes.

Microprocessor based digital control of all display parameters ensures secure and reliable setting up. Handling of a wide range of display modes is made easy by a choice of 22 preset modes; 14 factory preset, and the other eight user definable. This allows exactly the same image scaling and display parameters to be recalled instantly at any time simply by pushing a button — for example, to match a specific graphics card, workstation or application program.

Thanks to autoscan, the Brilliance 2110 automatically recognises the horizontal and vertical scanning frequencies of the graphics card to which it is connected, and selects the corresponding display mode. Different modes can be manually selected if desired.

Working precision is further enhanced by a colour-matching function, with a choice of three colour temperature modes: standard 6500K or 9300K settings; and a user definable mode with individual RGB adjustment. This function allows a desired colour balance to be achieved with digital precision — an important benefit in applications where critical matching of external colour reference is needed.

The Brilliance 2110 retails for around $6000, including tax; with two smaller 17" models 1709 and 1710 at $2280.

For further information circle 161 on the reader service coupon or contact Philips Components, 34 Waterloo Road, North Ryde 2113; phone (02) 805 4455.

Fast, heavy duty matrix printers

Speeds of up to 900 characters per second and workload capability of more than 20,000 pages per month are promised in a new printer family from Siemens. Known as the MT360 and MT350, they are targetted at users of high power PCs, networks and multi-user systems.

As well as replacing Mannesmann Tally's long standing MT460 and MT490 series, the printers, in particular MT360 address the very top end of the matrix market, with a throughput of more than 500 pages per hour.

The MT360 and MT350 come with both Centronics parallel and serial RS232 connections as standard. Both of these interfaces may be active at the same time, allowing two systems to be connected to one printer. As a further aid to installation, the printers also have an auto-ranging power supply. As standard the printers have eight resident fonts, including OCR-A and OCR-B, and offer barcode printing (MT460D compatible). Industry standard emulations and interfaces are available.

For further information circle 163 on the reader service coupon or contact Siemens Advanced Information Products, 544 Church Street, Richmond 3121; phone 008 032 954.

High speed oscilloscope card

Gage Applied Sciences has released a 100 megasample/sec digital storage oscilloscope card for PC's, for applications requiring high speed acquisition and storage. The Compuscope 250 runs at 100MSps on channel A or at 50MSps on channels A and B simultaneously sampled. The two channel card, with AC or DC coupling has the capability of driving slave units to provide up to eight channels at 100MSps, or 16 channels at 50MSps. The card can trigger from channel A, channel B, externally, or from the keyboard, and with its on-board memory, will allow mid, post or pre-triggering to capture relevant waveform information even at full sample speed.

The timebase is independent on all channels and can sample from 1Hz to 100MHz in a 1-2-5 sequence. The card fits any PC-XT/AT/386 and has available driver software for incorporating the Compuscope 250 into the user's own software.

For further information circle 165 on the reader service coupon or contact Boston Technology, PO Box 415, Milsons Point 2061; phone (02) 955 4765.

COMPUTER PRODUCTS

New CD-ROM drive

Toshiba has released a built-in type 12cm (5.25") CD-ROM drive which attains a sequential data transfer rate of 330KBps, with an average 200ms random access to data stored on disc. The XM-3401B is a 2x rotational speed CD-ROM, with a disc rotation speed between 440 and 1170rpm, a range 2.2 times faster than that achieved by Toshiba's earlier XM-3301B.

New components, such as an optional pick-up for sensing the laser beam reflections from the disc, and improved dedicated ICs, including error correction devices, support the high rotation speed and the high speed read and access times.

The low power consumption drive motor (average 4W) allows the XM3401B to enjoy greatly enhanced reliability, as a result of its completely sealed drive mechanism — which does not require an air vent to avoid overheating. Removing the air vent assures dust-free operation and prevents read errors, the most common cause of service maintenance.

Sharer for LaserJet 4

ASP Computer Products has released a wide range of printer connectivity enhancements for the HP LaserJet 4 printer. The products announced include the ServerJet SJ series of printer sharers and the JetLAN JLS series of Novell LAN adaptors, which plug into the MIO (Modular Input/Output) slot found in the new HP printer.

The five new ServerJet and two new JetLAN models take full advantage of the LaserJet 4's MIO interface — users can activate functions such as 'job offset' and 'auto language switching' directly from the printer's control panel. The self-diagnostic information provided by the JetLAN and ServerJet becomes part of the printer's self test report.

As many as 10 users can now share any HP MIO device. Because each port is independently configurable, users can completely customise their printer setup. Multiple users can simultaneously print as though they had their own personal printer, and send their jobs to the ServerJet's buffer (256KB standard, upgradable to 4MB) at speeds that reach 115.2kbps. The menu driven software that comes with the ServerJet allows users to easily change printer settings, or switch between different printers on the fly, directly from their computer.

The JetLAN JLS also slips into the HP's MIO slot, turning the printer into a stand-alone printer server on any Ethernet network running Novell NetWare. This eliminates the need to dedicate a PC to manage routine network printing jobs, and allows network administrators to keep file servers in secure locations. It directly connects the printer to the network wherever it is most convenient for users, and improves network performance by reducing the amount of data that the file service has to manage.

The RRP (including tax) for the SJ models is $727 to $1278, depending on configuration, and RRP for the JLS100 and JLS200 is $1242. For further information circle 170 on the reader service coupon or contact Sprinter Products, PO Box 259, Manly 2095; phone (02) 977 8155.

Handheld scanner

Genius Australia has released a new range of handheld scanners which have been keenly priced to capture a large share of the PC Windows market. Retailing from $297 to $882, Genius' HiScan black and white and colour range is priced to attract new users. The price includes improved photo and optical character recognition (OCR) software.

All three handheld models offer multi-scan function with a scanning width of 105mm. The Genius GS4500 black and white scanner has a selectable resolution of 100 - 400dpi.

It offers the functionality of other entry level scanners, plus the ability to scan in text or convert black and white images into 256 grey scale images.

The Genius GSB105 is a 256 true grey scale scanner (100 - 400dpi selectable). Users can create professional images for all their desktop publishing needs, and convert text using all popular word processing packages. It also features automatic merge function which enables users to stitch multiple scans into crisp, full page images.

The top of the range Genius GSC105 adds the power of brilliant 4096 colour images to all Windows-based applications. Its fluorescent scanning light enables greater accuracy in scanning colour images, especially line art and photographs. It provides a number of sophisticated features, including the ability to cut, retouch, paste, resize and blur or sharpen colour images to suit requirements. The range is bundled with an interface card, iPhoto Deluxe and GO-CR text recognition software.

For further information circle 167 on the reader service coupon or contact Genius Australia, 4 Briar Street, Fulham Gardens 5024; phone (08) 356 7337. ❖

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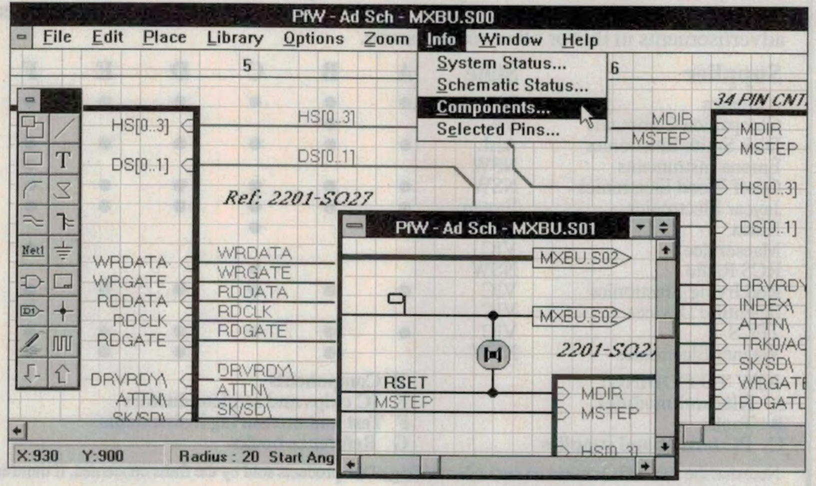

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